

# Connecticut's Historic Highway Bridges



Connecticut Department of Transportation



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by  
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U.S. Department  
of Transportation

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### *front and back cover:*

Bridge No. 1138, Route 82 over Connecticut River,  
East Haddam, 1913 steel swing bridge

# CONTENTS

|           |                                                |
|-----------|------------------------------------------------|
| 1 .....   | INTRODUCTION                                   |
| 3 .....   | BUILDING THE BRIDGES OF CONNECTICUT            |
| 18 .....  | HISTORIC CONNECTICUT HIGHWAY BRIDGES           |
| 18 .....  | Covered Bridges                                |
| 24 .....  | Masonry Arches                                 |
| 38 .....  | Iron and Steel Bridges                         |
| 58 .....  | Concrete Arches                                |
| 72 .....  | Merritt Parkway Bridges                        |
| 78 .....  | Movable Bridges                                |
| 85 .....  | PRESERVATION CASE STUDIES                      |
| 91 .....  | Bibliography                                   |
| 92 .....  | Glossary                                       |
| 95 .....  | National Register Listings and Recommendations |
| 101 ..... | Index Map                                      |

# INTRODUCTION

**C**onnecticut has a rich diversity of historic highway bridges. In addition to three of the covered wooden bridges that have become a symbol of the New England landscape, Connecticut has an abundance of picturesque stone arches, iron trusses from the Victorian period, and concrete bridges with outstanding ornamental effects. These structures are part of our heritage. They tell of past generations' building traditions, technological expertise, and ideas about beauty. Like old houses, churches, barns, and town greens, early bridges remind us that the communities of Connecticut have a long history.

This book is a guide to the most outstanding of Connecticut's historic bridges. More than forty individual bridges are illustrated and described in detail, and there is a section on the bridges of the Merritt Parkway, Connecticut's largest highway project of the 1930s. Other parts of the book present a capsule history of bridge building in Connecticut and a series of case studies showing how landmark bridges can be saved through rehabilitation, relocation, and other preservation strategies.

The information on these bridges comes from the Connecticut Historic Bridge Inventory, a

project undertaken by the Connecticut Department of Transportation in cooperation with the Federal Highway Administration and the Connecticut Historical Commission. The Historic Bridge Inventory had as its first goal the identification and assessment of all Connecticut highway bridges, both state and town-owned, that have historic significance. With a few exceptions, the Inventory was limited to bridges at least 20 feet in length and built before 1940. Railroad bridges were not included, except for bridges that carry highways over railroads and railroads over highways. Using the criteria of the National Register

of Historic Places, a total of 124 bridges were judged to have historical significance. Eleven highway bridges were already listed on the National Register before the project began.

The second goal of the project was to create a Preservation Plan for the state's historic bridges. As the last section of this book demonstrates, with proper planning many bridges built more than a century ago can continue to provide safe and practical solutions to today's transportation needs. Other historic bridges can be preserved by moving them to new locations, such as hiking trails, that are less

demanding than highways. Still others can be left in place for pedestrian use or as scenic resources while modern bridges carry a bypass route. Yet despite everyone's best efforts, it may not be practical to save all of the state's historic bridges. An archival record will be made of any historic bridge which is demolished as part of the State's bridge improvement program. Full details of the Preservation Plan and other aspects of the Historic Bridge Inventory are contained in a two-volume technical report available from the Connecticut Department of Transportation.

*A note on bridge numbers and names: throughout this book, bridge numbers are taken from the State Highway Bridge Log. These numbers usually are stencilled somewhere on the bridge. Certain bridges no longer in service, short bridges, and bridges which intersect railroads have not been assigned numbers. Traditional or common names of bridges are used wherever possible; in other cases, the name of the road is used to identify the bridge.*

## BUILDING THE BRIDGES OF CONNECTICUT

3

Connecticut's bridges have changed markedly since the time when some colonists first laid rough-hewn timbers over a stream. Better materials, new technologies, and the rise of professional engineering all played a part in the story. But equally important were the changing transportation needs of Connecticut's citizens. The farming communities of the Colonial period needed only the most rudimentary structures, but modern industrialized society, with its dependence on automobiles and trucks, requires much more. Not surprisingly, the arena of transportation decisions has changed as fully as the bridges themselves, from local government, to state government, to the federal-state partnership that accounts for much of the bridge building in our own time.

### BRIDGES IN COLONIAL CONNECTICUT

In the Colonial period, bridges were the responsibility of Connecticut's individual towns. Each year people at the town meeting elected several high-

way surveyors, who then took charge of the roads and bridges in particular sections of town. Money for construction and repairs came from the town's annual highway tax, levied on households according to how much land they owned. Residents who were short of cash could pay all or part of their highway tax by working on the roads, by providing the town with a team of oxen, or by furnishing timber for bridges.

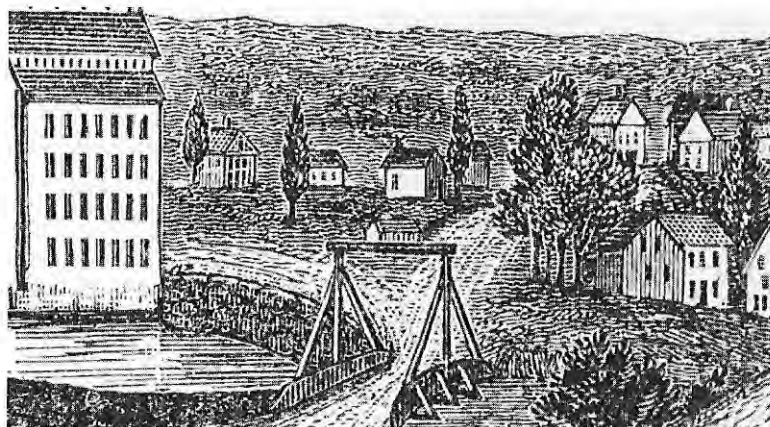
Most of these early bridges were short spans built of wood. Except for stone slabs used to cross run-off ditches and other small streams, masonry bridges were too expensive. The timber bridges of the Colonial period, even

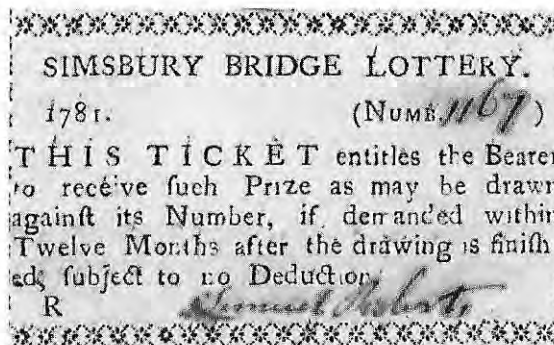
when braced by simple truss forms such as the king-post truss, were limited to a length of about fifty feet.

Wider streams had to be bridged by a series of spans resting on intermediate stone piers, and ferries provided the principal means of crossing the state's largest rivers, including the Connecticut, Housatonic, Naugatuck, and Thames.

Few towns planned ahead or took a broad view of their transportation requirements. Instead, bridge construction and maintenance responded to petitions from townspeople, and it was carried out at the lowest possible cost. Such localized, informal planning was appropriate for a society made up

SIMPLE  
KING-POST  
TRUSS,  
WILLIMANTIC,  
SHOWN IN  
AN 1838  
ENGRAVING.





largely of farmers. Most people had to travel only to a few neighboring farms, to the gristmill, to the meetinghouse, and occasionally to a store. The system worked less well when many bridges had to be replaced or repaired at once, such as in 1795, when a spring flood washed out dozens of bridges in the Farmington Valley. The towns responded by doubling the highway tax, creating a hardship for many families.

Toward the end of the 18th century, people began to recognize the need for improved overland transportation. During the Revolutionary War, British control of Long Island Sound had forced the colonists to move troops and provisions over woefully inadequate Connecticut roads. Also, Connecticut's growing commerce in agricultural produce and timber products, while relying primarily on water-borne transportation, still had to be carried in wagons for the first part of the journey. Several large bridges were built over major rivers in this period, most by private companies that had received a charter from the legislature

permitting them to build a bridge and charge tolls. The magnitude of these projects often required special financing. In 1781, to pay for a bridge across the Farmington River in Simsbury, the General Assembly authorized a lottery, the most common method of raising capital for major public construction projects.

## THE ERA OF TURNPIKES AND CANALS

In the 1790s and early 1800s, Connecticut's General Assembly authorized many turnpikes, which were toll roads of supposedly superior quality built and operated by private companies. The legislative charter for each turnpike specified the general route and the allowable tolls. Then the company surveyed and constructed the road subject to approval from the General Assembly. That approval process provided citizens the chance to protest planned routes and suggest alternatives, as many did. In 1803, for instance, the villages of West Britain and New Cambridge, in the town of

Bristol, vied to be on the route of a proposed turnpike. Both villages feared economic stagnation if the turnpike passed them by, but they debated the route in terms of efficient transportation and the cost of construction. The residents of West Britain claimed that the route closer to them was on "hard firm soil, destitute of sand, the hills not tedious, and [had need of] fewer expensive bridges." Nevertheless, New Cambridge won out by paying for the survey of an alternative route and promising to build two bridges for the turnpike, which roughly followed what is today Route 6. More than 120 companies received turnpike charters and, while not every one managed to complete a road, turnpikes crisscrossed the state by 1820. Like town bridges, most of the hundreds of bridges built by the turnpikes were wood, but the ability to raise money from investors and charge tolls allowed more stone-bridge construction.

The towns continued to exercise authority over bridges, particularly when concern over a structure's

adequacy caused citizens to complain. In 1797, a bridge on the Hartford-Albany turnpike came under scrutiny when the town of Farmington appointed a committee to examine the bridge. Their report found the bridge "so far decayed that we consider it unsafe and hazardous." The public was assured that it would be replaced "as soon as the season and the nature of the business permit." The town did not want to be held liable for any mishap connected with the old bridge, and to fulfill its obligation to the traveling public, placed a notice in the *Connecticut Courant*:

*Travellers and others will therefore do well to stop, consider, and look before they leap, as the town will not expect to be responsible for any loss or injury that may be sustained in consequence of the insufficiency of the present bridge.*

At the same time that turnpike companies were improving roads, the legislature chartered several toll-bridge companies to build and operate large bridges. In 1807, a company was

authorized to build a new bridge over the mouth of the Housatonic River between Stratford and Milford (aided by a lottery), and in 1808 the state's first bridge across the Connecticut River was built at Windsor. Two years later, despite considerable opposition from ferrymen, a second toll-bridge was completed at Hartford. It lasted only eight years before being swept away in the spring of 1818. It was then replaced by a covered bridge which stood for more than 75 years.

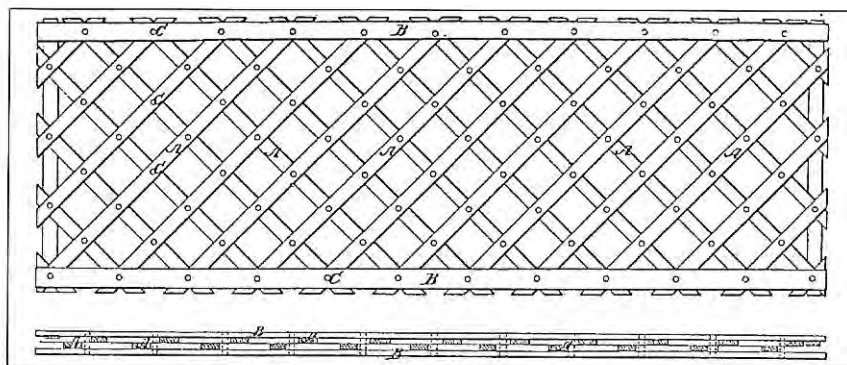
These bridges were able to take advantage of improvements in timber bridge building that had only recently

been developed. The Hartford bridge of 1818 consisted of six arch-trusses over 150 feet in length, built according to a design patented by Theodore Burr in 1804. The Burr design used a web of king-post trusses reinforced by an arch. Burr's design allowed for span lengths far greater than that of simple-truss timber bridges, and when roofed over to protect the bridge from the elements, it made a durable structure.

Although more economical than comparable spans in stone, Burr trusses still required expensive, specialized labor in their construction. That problem was addressed by Ithiel



**BURR  
TRUSSES  
OF THE  
1818  
HARTFORD  
BRIDGE.**



PATENT  
DRAWING  
OF TOWN'S  
LATTICE  
TRUSS.

Town, who patented his design for a lattice truss in 1820. After his youth on a Connecticut farm, Town studied in Boston with Asher Benjamin, one of the nation's most accomplished architects, then moved to New Haven to run a building contracting business. In partnership with Isaac Damon, Town constructed three bridges over the Connecticut River before 1820, including the Burr truss at Hartford. In Town's lattice design, the truss consisted of simple planks set diagonally between top and bottom chords and joined at their intersections with "treenails," or wooden pins. The Town lattice truss saved on material because it did not require massive timbers, and on labor because it did not use intricate mortise-and-tenon joints. Town promoted the bridges through pamphlets and traveling sales agents. By 1834, lattice trusses had been built throughout the New England and Middle Atlantic states and as far away as Alabama. Two of the three wooden

covered bridges remaining in Connecticut are Town-lattice trusses.

Another significant development in Connecticut transportation occurred in the 1820s, when two canals were built. The Enfield, or Windsor Locks, Canal bypassed dangerous rapids on the Connecticut River, thereby opening up navigation between Hartford and the upper Connecticut Valley. The Farmington Canal linked New Haven with Northampton, Massachusetts. None of the numerous

wooden bridges built to carry farm roads over the canals have survived.

## BRIDGES IN THE INDUSTRIAL AGE

Railroads completely supplanted canals in Connecticut during the 1840s. Like canals, they were self-contained transportation systems that nonetheless had enormous impact on highways in the surrounding communities. Where high embankments carried the tracks, passages had to be cut through for local road traffic, often by means of arched masonry tunnels.

RAILROADS  
ACCOMMODATED  
PRE-EXISTING  
FARM ROADS WITH  
STRUCTURES LIKE  
THIS SMALL  
TUNNEL,  
c. 1850,  
IN LISBON.



Two such crossings can be seen today in eastern Connecticut, along the route first built in the late 1840s by the Hartford, Providence and Fishkill Railroad. Rail access also transformed the character of numerous quiet villages, causing massive increases in commercial feeder traffic and stimulating the development of local industries. To cope with such growth, towns needed to build more bridges and replace old ones with stronger spans.

Railroad construction stimulated further developments in bridge technology. A timber truss patented in 1840 by Massachusetts millwright William Howe incorporated wrought-iron vertical tension members that could be tightened with turnbuckles. For ten years it was the standard truss used in railroad bridges, and survived even longer for highway bridges. The covered bridge across the Salmon River between Colchester and East Hampton is a Howe truss. Railroads, however, soon turned to all-iron trusses for bridges which could meet the



**BERLIN  
IRON BRIDGE  
COMPANY'S  
DISTINCTIVE  
BUILDER'S  
PLATE.**

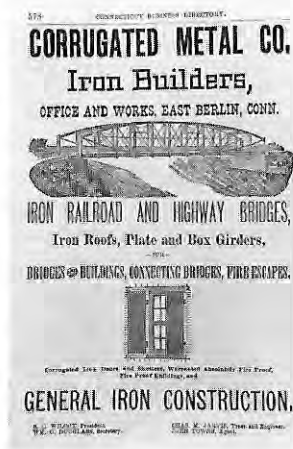
demands of heavier rolling stock and higher speeds. The first practical iron trusses, which would transform the nation's bridge technology, were developed by two engineers working for the Baltimore and Ohio (B & O) Railroad, Wendel Bollman and Albert Fink. Like timber trusses, their designs were based on the principle of using diagonal members to transmit vertical load from the center of the bridge to the abutments. The B & O used iron trusses extensively for spans of up to one hundred feet as it extended or improved its western routes.

Bollman also led the way in establishing the structural fabrication industry as an enterprise independent from the railroads. He left the B & O in 1858 to start his own bridge firm, which (except for suspending operations during the Civil War) flourished

until his death in 1884. The pattern repeated itself throughout the United States after the war, as dozens of railroad engineers either started firms or allied with iron works to pursue the growing bridge market.

At first, metal-truss bridges were primarily used on railroads. But by 1870 they increasingly found favor with local highway officials, who were seeking bridges that would be stronger and more durable than wooden trusses (which probably lasted less than 25 years on average) and cheaper than masonry construction. From the late 1860s through end of the 19th century, intense competition pervaded the bridge industry. Rival sales agents often touted the particular qualities of their firm's patented designs, such as less material and lower cost, greater strength, or even more handsome appearance. Berlin Iron Bridge Company, Connecticut's only major bridge fabricator, was one of the pre-eminent examples of a company that used a distinctive product as an aid in marketing.

Berlin Iron Bridge Company had its origin in the sheet-metal industry of central Connecticut, which in turn had grown out of the tinware trade. The direct predecessor of Berlin Iron Bridge was the Corrugated Metal Company, a manufacturer of roofing material. In the mid-1870s, the firm moved into fabricating iron roof trusses, which were needed to support its heavy corrugated roofing. Meanwhile, William Douglas of Binghamton, New York, had developed an American version of the lenticular or parabolic bridge truss that had been used in Europe since the 1850s. Douglas hired a young Yale graduate, Charles Jarvis, to help with production, and engaged Corrugated Metal to handle the fabrication. The firm may have begun selling the bridges as early as 1877, a year before Douglas received a patent for the design.



Active marketing began in earnest in 1878, particularly in the region near the factory in East Berlin. Waterbury's Washington Avenue Bridge, erected during the summer of 1878, was one of the earliest sales, and is the oldest lenticular truss known to survive.

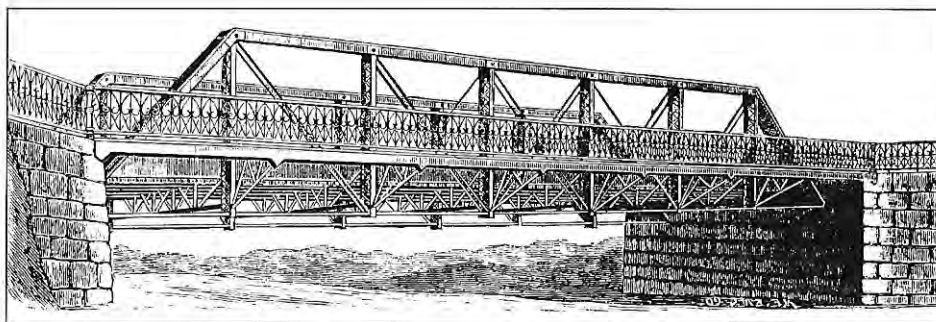
The Douglas truss has a lens-shaped profile, with the bottom chord curving upward to meet the top chord at the end posts. This distinctive appearance, and an advantage in cost because the lenticular truss used 10 percent less metal than the more common types, were the principal selling points exploited by the agents. Bridges soon became the firm's major product, and in 1883 the name was changed to Berlin Iron Bridge Company.

Not every sale to town officials depended on claims of technical superiority or cost efficiency.

Collusion and bid-rigging were an integral part of commerce in the 19th century. An agent for the Groton Bridge Company of New York recalled one such circumstance involving local highway officials in Vermont who solicited bids from his firm, from King Iron Bridge in Ohio, and from Berlin Iron Bridge:

*Well, they opened the bids and the Ohio man was way high. Next was our bid — \$908.14. And when they opened Berlin's bid it was exactly the same, right to the penny! The Berlin man and I were flabbergasted, but the commissioners thought it was funny. Finally one of 'em pulled out a shiny silver dollar and we flipped for the bridge contract. The Berlin man won and they built it. Later I met up with him again over East, under just about the same circumstances. That time our bid was just eighteen cents under his and we got the job. Bridge business was fun in those days.*

Berlin Iron Bridge did not completely monopolize the iron-bridge market in Connecticut, but the



**PRATT  
TRUSS IN NEW  
HAVEN,  
1882.**

inherent economy in transportation to in-state locations made the firm a formidable competitor. Of more than 1,000 lenticular trusses built by the firm, nearly 10 percent were sold to Connecticut municipal governments. In addition to its lenticular trusses, the firm built spans designed by city engineers and railroads, such as the Pratt truss on Chapel Street in New Haven and the plate-girder span carrying the railroad over Asylum Street in Hartford.

Even while the lenticular truss achieved its peak of popularity in the late 1880s, two simpler trusses had already established themselves as the preferred types among engineers, fabricators and customers. The Pratt and Warren trusses and their variants had simplicity as their main advantage over the lenticular and other exotic trusses. It was easier to calculate the load capacity for these trusses, and the less complicated joints considerably eased the fabricating process.

Until the early 1890s, truss bridges of every pattern shared two important characteristics. First, their

connections featured large pins, up to three inches in diameter, that passed through holes drilled in the ends of the members. Pins were favored due to ease of assembly, even though engineers realized that riveted connections offered superior rigidity. In the 1890s, innovations in pneumatic field riveting overcame the cost advantage of pinned joints, and riveting became standard. Secondly, most trusses before 1895 were made from wrought iron.

Although an all-steel railroad bridge had been built as early as 1879,

many engineers and fabricators distrusted the material, especially for tension members. With the perfection of the open-hearth process of steelmaking around 1890, the performance of steel was no longer a serious question, and the common structural shapes (plates, channels, angles) soon became available at prices competitive with wrought iron. By 1895, as one eminent bridge engineer recalled, steel's "adoption for bridges was practically universal, and the production of wrought iron in large quantities was a thing of the past."

Economic consolidation in the bridge fabricating industry helped make standard the technological changes that had occurred. In a classic case of market dominance through financial manipulation, the banker J. P. Morgan in 1900 formed the American Bridge Company. In its first year American Bridge purchased 24 bridge companies (including Berlin Iron Bridge) and thereby controlled half the nation's fabricating capacity. In 1901 American Bridge was itself purchased by U.S. Steel, the largest producer of structural steel. This



**TYPICAL  
PINNED  
JOINT.**



**TYPICAL  
RIVETED  
JOINT.**

combination achieved immediate control of the bridge market, leaving the survivors to fight over scraps from the giant's table. In a pattern frequently repeated, executives of Berlin Iron Bridge left the new monopoly after a short time and started over in their original home area. Like the rest of the smaller firms, the new Berlin Construction Company (later renamed Berlin Steel Construction Company) competed in a regional market by capitalizing on existing contacts with local highway officials and whatever advan-

tage in transportation cost it could offer over American Bridge.

Although hundreds of small metal trusses were built on Connecticut highways in the period 1870 to 1910 (some towns bought more than a dozen from Berlin Iron Bridge alone), they did not completely supersede timber and masonry bridge construction. In two projects in the decade following the Civil War, the towns of Watertown and Colchester both considered iron bridges, but instead built a stone arch and a wooden covered bridge. Stone

and timber bridges had the advantage of using easily available materials and local labor.

Many towns chose stone bridges because they were especially strong and durable. As industries proliferated in Connecticut, the danger of flooding increased. During periods of heavy rains, mill dams would burst, washing out all the bridges downstream. When a storm in October of 1869 caused waters to rise, so many dams failed in Glastonbury that seventeen of the town's eighteen bridges

were destroyed; most were replaced with stone arches.

Stone bridges were also favored for their beauty. Many arched bridges, even in the smaller towns, had carefully cut ring stones and other decorative features that served an aesthetic purpose rather than functional purpose. In the early 1900s, many cities and



**AFTER  
CONSIDERING  
AN IRON  
TRUSS, THE  
TOWN OF  
WATERTOWN  
CHOSE TO  
BUILD THIS  
BRIDGE IN  
STONE IN  
1865.**

**CHRISTOPHER  
ALLEN BRIDGE,  
STAFFORD  
SPRINGS,  
1912, AN  
EXAMPLE  
OF A "CITY  
BEAUTIFUL"  
BRIDGE.**

bridges, the sides of the arches and the railings were often finished with stone for the sake of appearance.

## THE CONNECTICUT STATE HIGHWAY DEPARTMENT

In 1895, the State of Connecticut took the first step toward centralized transportation planning and administration by establishing the Office of the Connecticut Highway Commissioners. Because of disproportional representation, the Connecticut Legislature was controlled by rural towns, and the Highway Commissioners' Office explic-

large towns chose to build impressive stone arches as part of civic-improvement programs. The "City Beautiful" movement, as it was called, so favored stone-arch construction that even after reinforced concrete became the dominant material for

itly set out to benefit farmers, who even then were a minority of the state's population. The Highway Commissioners' main function was to distribute a modest state appropriation of \$75,000 to towns for widening rights-of-way, eliminating steep hills, improving drainage, and resurfacing roads with packed-gravel pavement. The average grant was less than \$900, and the towns had to match the state contribution. In 1897 the legislature reduced the number of Commissioners from three to one and added a small professional staff to the agency, thereby creating the State Highway Department.

The size of the program's grants precluded substantial bridge work on most projects. However, the Highway Department did promulgate technical standards for state-aided bridges, such as a minimum width of 12 feet. Also, through competitive evaluation of applications for state aid, the Department was able to encourage the towns to build stronger bridges. "The makeshift toy bridges of the past will not be tolerated in the days to come,"

declared the Department in 1899.

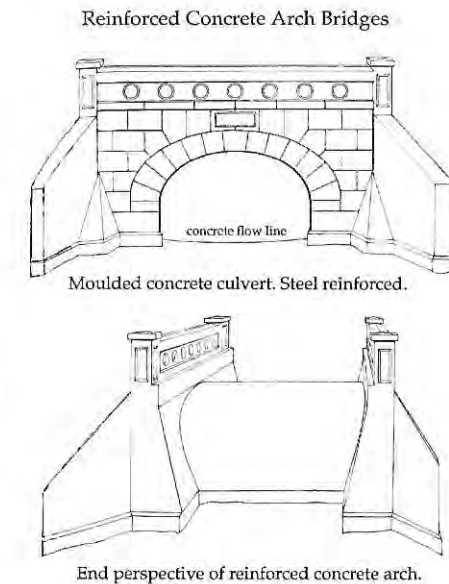
The bridges most in need of improvement were those that carried major highways over the state's larger rivers. But because of its rural orientation and its reliance on town initiative, the State Highway program did little for the main through routes, then called "trunk lines," that connected the state's urban centers. In fact, Commissioner James A. MacDonald opposed spending money on such roads because he thought they siphoned off the economic vitality of farming areas into the cities. Even Connecticut's busiest highway, the Boston Post Road, he insisted, could be improved by the individual towns through which it passed, given the engineering expertise and matching funds available from the state program.

The limited role staked out by the State Highway Department in the 1890s changed abruptly in response to pressures brought by a new mode of transportation—the automobile. Packed-gravel pavements were unsuitable for motor-vehicle traffic, as were



the lightly constructed, narrow bridges being erected by the towns. Moreover, as motor trucks captured some of the long-distance freight formerly monopolized by the railroads, business and industry came to depend on good-quality highways. These interests made themselves heard in the General Assembly, which in 1905 created the state's trunk-line system, and gave the Highway Department direct authority over the state's fourteen major through highways. Besides the Post Road (now U.S. Route 1), the trunk lines followed the approximate course of present-day Routes 2, 4, 6, 7, 8, 9, 10, 11, 12, 14, 15, 34 and 44. In addition to money for distribution to the towns, the State Highway Department was now authorized to spend money directly to improve and maintain the trunk lines.

The Highway Department's goals had undergone a fundamental change from just eight years before. The Department now responded to the interests of commerce and the internal-combustion engine, and the conservatism of small-town governments



stood in the way. MacDonald argued that trunk lines suffered because the towns did not initiate enough projects or appropriate sufficient money. The General Assembly complied with his request to eliminate the annual cap on state expenditure in any single town.

**THE STATE  
HIGHWAY  
DEPARTMENT'S  
SUGGESTED  
DESIGN FOR  
CONCRETE  
ARCHES,  
1907.**

Bridges necessarily became a major component of trunk-line improvement. The Boston Post Road crossed several large rivers on town-operated or private ferries that charged tolls. Commissioner MacDonald recommended for the short term that the state take over the ferries, and again the legislators complied. Meanwhile, the Department began the planning for several large bridge projects.

In 1907 the Department also started promoting a relatively new structural material, reinforced concrete. A few towns had already adopted concrete, notably West Hartford, which built one of the state's first concrete-arch bridges in 1901 and added several more in the next few years. The Connecticut Society of Civil Engineers examined concrete construction in 1903 and enthusiastically endorsed the new material for bridges. Comparing concrete arches with steel trusses, the engineers favored the unobstructed roadway, faster construction and lower maintenance cost of the arches.

The Highway Department urged

towns to adopt concrete and printed standard designs in its 1907 report, but it still lacked the funding needed to undertake major bridge projects on its own. Conservative spending remained the order of the day, especially after the recession of 1907. From 1909 through 1913 the General Assembly would not even fund the printing of the Highway Commissioner's annual report. Instead of a coordinated bridge program, the legislature authorized the construction of important bridges on a case-by-case basis, creating a special commission to build each bridge and requiring the towns that were directly affected to pay most

of the cost.

Charles J. Bennett assumed charge of the State Highway Department in 1913. He spent two years improving relations with the legislature and reorganizing the office. After receiving the first increase in administrative expenses since 1907, he hired additional professional staff to head the new operational divisions he established within the office: construction, maintenance, and accounting. Bennett also divided the state into seven highway districts, and assigned to each an engineer who was responsible for reviewing all state-aided local road projects. He adopted as a primary

goal the complete upgrade of the trunk-line system to make it suitable for automobiles and trucks.

In 1915, Bennett convinced the General Assembly to grant his office authority over all the state's bridges. Construction money was still very limited, however, and it was restricted to a handful of critical crossings rather than a general appropriation for a statewide bridge program. The first structure designed and constructed by the Highway Department was a concrete-beam bridge carrying Boston Post Road over the Saugatuck River in downtown Westport. Following that, the state engineers designed the concrete-arch bridge over the Housatonic River between Derby and Shelton.

In 1916 the Highway Department gained a powerful ally—the United States government. The Federal Aid Road Act made a limited amount of federal

**EAST HADDAM  
BRIDGE UNDER  
CONSTRUCTION,  
1913, ONE  
OF THREE  
LARGE BRIDGES  
BUILT BY  
SPECIAL STATE  
COMMISSIONS.**





**CONCRETE-BEAM  
BRIDGE,  
WESTPORT,  
COMPLETED IN  
1917 -- THE  
STATE HIGHWAY  
DEPARTMENT'S  
FIRST BRIDGE.**

matching funds available to support the state's overall construction program. The Highway Department apportioned the money according to its own priorities, and federal officials approved the allocations and designs. Bennett devoted most of the federal cost-share to the two trunk-line programs: bridge reconstruction and removal of dangerous conditions (poor paving, sharp curves, hills). Federal money allowed the Highway Department to pursue the long-deferred goal of improving the river crossings on Boston Post Road,

the allocation of steel to military purposes during World War I, and the bridge was not completed until 1921. The following year, the bridge over the Mystic River between Groton and Stonington completed the upgrade of the road to serve the needs of burgeoning automotive traffic.

Many of the Post Road projects incorporated the latest in movable bridge technology. Shoreline communities such as Westport, Stratford, and Mystic were all located on rivers that were navigable, at least by small craft, and the new bridges had to provide clearance for maritime traffic. Most used a bascule, a modern version of the medieval drawbridge, which in the early 20th century was reaching the

which remained the most heavily used route in the state. Planning for Washington Bridge, over the Housatonic, began in 1917 but construction was delayed by

peak of its technological development.

The Federal Aid Road Act and subsequent amendments encouraged participating states to establish technical specifications for road and bridge construction. Partly in response, and partly to minimize the engineering work on the 15,000 miles of roads in the state, the Connecticut legislature in 1924 directed the Highway Commissioner to establish and distribute "Standard Specifications" for construction. In 1927 the Department issued these specifications, which have been updated every two to five years since. The

**MYSTIC  
RIVER  
BRIDGE,  
1922,  
AN EARLY  
ROUTE 1  
BRIDGE.**





**STANDARD  
WARREN-TRUSS  
STATE  
HIGHWAY  
DEPARTMENT  
BRIDGE OF  
THE 1920S  
AND 1930S.**

specifications did not include any specific bridge designs, but they did indicate a strong preference for concrete bridges and effectively limited metal trusses to the Pratt and Warren designs that had become standard in the bridge industry. By also stipulating such items as methods of materials analysis, rivet spacing for trusses, and surface finishes for concrete spans, the Department set the character of the bridges that would be built throughout Connecticut. Even those bridges designed by private engineering firms, or paid for by individual towns, followed the Department's standards.

Despite the continual expansion of its responsibility and budgets in the 1920s, the State Highway Department struggled to build and maintain roads and bridges that would be adequate for constantly increasing traffic. In the early 1930s the Department assumed the additional responsibility of long-term planning, made possible in part

by general-obligation bonding for highway and bridge construction. Bonding helped the program by spreading out the cost of improvements over a period of years.

In addition to exercising a supervisory role, the Department's engineers themselves designed some of the state's largest bridges of the period. These monumental structures include a number of open-spandrel concrete arches, such as the 1930 Reynolds Bridge in Thomaston, the 1930 Cornwall Bridge, and the 1934 Hammonasset River Bridge, as well as several large steel trusses, such as the 1934 Lake Zoar bridge and the 1936 Butts Bridge in Canterbury.

The highway between New York and New Haven continued to demand the attention of State Highway officials. Despite an improvement program in the mid-1920s, it was still the most frequently jammed and accident-prone road in the state. The Highway Depart-

ment's Warren M. Creamer described the situation in a 1936 address to the Connecticut Society of Civil Engineers:

*It is certain that many of you have occasion to use the Post Road; have doubtless in your journey from Bridgeport to New York City been confronted by an amazing succession of traffic lights . . . have passed through the city and town streets . . . ultimately arriving in the city, nerves on edge and facing exhaustion.*

To alleviate the jangled nerves of shoreline travelers, the Department undertook construction of a four-

**THE STATE  
HIGHWAY  
DEPARTMENT  
BUILT A  
HALF-DOZEN  
OPEN-SPANDREL  
CONCRETE ARCHES  
IN THE EARLY  
20TH CENTURY.**



lane parkway from Greenwich to the Housatonic River at Stratford. Completed in 1938, the Merritt Parkway was designed by the Department's staff under Creamer. The project also involved several consulting engineers, landscape architects, and architect George Dunkelburger, who designed the decorative details and finishes for some 60 concrete bridges.

The Merritt was widely hailed as the epitome of American parkway construction, a uniquely well-fulfilled combination of effective traffic-carrying capacity and aesthetically pleasing design. Also in 1938, the Department reported the completion

of the largest single structure it had ever undertaken — the steel-arch Arrigoni Bridge over the Connecticut River at Middletown.

Bridge work in Connecticut in the 1930s benefited not only from ordinary federal-aid appropriations but also from the numerous New Deal programs enacted during the presidency of Franklin Roosevelt. The Works Progress Administration built many new bridges in local and state parks, often using picturesque stone construction, and the Civilian Conservation Corps rehabilitated the Salmon River covered bridge. After the Hurricane of 1938 destroyed dozens of bridges, federal work-relief funds allowed the state and towns to undertake speedy reconstruction.



**THE HURRICANE OF 1938 DESTROYED DOZENS OF CONNECTICUT HIGHWAY BRIDGES LIKE THIS ONE IN BALTIC.**

Today the State Highway Department's successor, the Connecticut Department of Transportation, is engaged in another program of major improvements to the state's roads and bridges. In partnership with the Federal Highway Administration, the Department is continuing its long tradition of providing safe and efficient transportation. At the same time, the Department's planners and engineers are confident that through proper planning, the program can preserve many of the historic highway bridges that stand as monuments to the state's transportation and engineering heritage.



## COVERED BRIDGES

**A**lthough today seen as nostalgic links to America's rural past, covered bridges were high technology for their time. Covered bridges used the timber construction familiar to Americans of the early 19th-century and in one sense, they were simply elaborations of the basic principle of the truss, which was the use of diagonal members to transfer vertical forces in a horizontal direction. What made them innovative was that they multiplied the basic truss pattern many times over. The patented truss systems employed in covered bridges allowed them to span a much greater distance than was possible with the timber-beam or king-post bridges of the Colonial era.

Covered bridges, at least in the beginning (the first covered bridge in America was built in 1805), were constructed not by local carpenters but by builders with special expertise in bridges. Isaac Damon of Northampton, Massachusetts, for example, built many of Connecticut's early wooden bridges. Improvements in truss design simplified covered-bridge construction. Ithiel Town's

1820 patented lattice truss had no complicated mortised joints and required no large timbers, only planks that were pegged together at the intersections. The truss patented by William Howe in 1840 used iron rods as tension members, leaving the timbers to bear only compressive forces. Connecticut today has examples of both these truss designs.

The roofs on covered bridges protected the trusses from rain and snow. Since the 18th century, simple trusses had been enclosed with planking, so adding a roof to protect the floor as well was simple common sense, especially since the roof structure added stability to the larger, longer trusses common in covered bridges.

## BULL'S BRIDGE (Bridge No. 4453)

- ❑ Bull's Bridge Road over Housatonic River
- ❑ Kent
- ❑ Covered timber truss
- ❑ Length: 110'
- ❑ Built in 1842



**B**ull's Bridge takes its name from Isaac and Jacob Bull, who started an iron-works here in 1760 and also built the first of at least five wooden bridges that have crossed this rocky, wooded gorge. The present span is believed to date from 1842. An example of the lattice truss

patented by Ithiel Town in 1820, the bridge carries what was once a major highway from Hartford to Newburgh, New York, on the Hudson River.

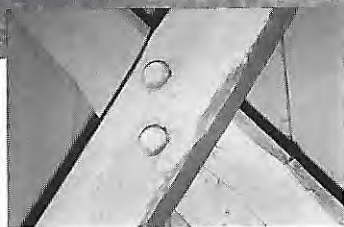
The bridge has undergone many changes since its construction. The queen-post trusses that surround the

Town lattices are probably not original to the bridge. Bull's Bridge was raised higher above the river as part of the development of a nearby hydroelectric station in 1901-1903. The State Highway Department replaced much of the lower chords and all of the treenails in 1949.

Finally, in 1969 large plate girders were installed beneath the bridge to carry the weight of the traffic, with the exterior sheathing extended to conceal them from view. Despite these alterations, the character of the original bridge is still plainly evident, a reminder of the age when Ameri-

cans relied on wood as their chief building material. The bridge was listed on the National Register of Historic Places in 1972.

Above right:  
**INTERIOR, SHOWING TOWN LATTICE  
AND QUEEN-POST TRUSSES.**



## WEST CORNWALL BRIDGE (Bridge No. 1338)

- Route 128 over Housatonic River ☐
- Cornwall - Sharon ☐
- Covered timber truss ☐
- Length: 172' ☐
- Built in 1864 ☐

West Cornwall's covered bridge is an excellent example of the Town lattice truss, with its red-spruce timbers secured by a pair of green nails (slotted and wedged to hold them in place) at every intersection. For many years it was thought that this bridge was built in

1841 to replace one washed away in the flood of 1837, but recent research by Michael R. Gannett for the Cornwall Historical Society has shown that the correct date is 1864. The center pier supporting the middle of the bridge was probably reused from the earlier structure. One

source gives 1887 as the date when a secondary queen-post truss was added, probably to stiffen the bridge, since wooden trusses had a tendency to sag.

In 1973 the Connecticut Department of Transportation rehabilitated the bridge by inserting a concealed

steel deck to bear the weight of the traffic.

The bridge was listed on the National Register of Historic Places in 1975.

Above lower left:  
**TREENAILS CONNECT THE BRIDGE'S  
TIMBERS AT EACH INTERSECTION.**

## COMSTOCK BRIDGE

- ❑ Over Salmon River north of Route 16
- ❑ Colchester - East Hampton
- ❑ Covered timber truss
- ❑ Length: 2 spans, 110' overall, 80' maximum span length
- ❑ Built in 1873



21

Comstock Bridge served travelers on the main road between Colchester and Middletown for nearly sixty years, until a new concrete bridge was built downstream in 1932. Now situated in a public park, Comstock Bridge is a well-preserved example of the Howe truss, an

innovative design patented in 1840. The Howe truss combined vertical iron rods and diagonal timbers and was widely used in railroad construction as well as for highway and factory bridges.

The 30'-long east span is significant in its own right as the

only remaining example in Connecticut of an enclosed wooden pony truss, that is, one with no overhead roof or other bracing. Generations before any covered bridges were built, bridge builders protected trusses from the weather by covering them with boards, and the technique

continued in use for shorter spans such as this one throughout the 19th century.

In the 1930s Comstock Bridge was extensively renovated by the Civilian Conservation Corps, a federal program that put unemployed young men to work improving parks and

forests. Among the changes introduced at that time were the present wooden gates and new siding salvaged from an old barn. In the early 1970s the bridge was again renovated. Steel gusset plates were added to reinforce the original wooden joints.



Comstock Bridge was  
listed on the National  
Register of Historic  
Places in 1976.



Above:  
**INTERIOR, SHOWING HOWE TRUSS.**



## MASONRY ARCHES

**B**ecause of its tremendous strength under compressive forces, stone can bear an almost unlimited load when arranged in the form of an arch. The ancient Romans used stone arches for large bridges and aqueducts, and the tradition of building bridges in stone continued in medieval and Renaissance Europe.

Bridges varied considerably in their masonry techniques. At its most basic, a stone-arch bridge could be built using flat or wedge-shaped field-stone laid up in the shape of an arch. Most bridge builders, however, used cut stone at least for the arch ring, since shaping the ring stones resulted in a more perfect arch. The sides or spandrels of the bridge were less critical; their function was simply to retain the fill for the roadway. Spandrels were often of rubble (randomly shaped stone) even when the ring stones were cut. In more ornate stone-arch bridges, the spandrel masonry was ashlar (rectangular-shaped cut-stone blocks).

Stone bridges cost far more than comparably sized

wooden bridges. Towns built them only on their most important roads. In the second half of the 19th century, many stone arches were built just downstream from mill dams. Bridges in these locations were in danger of being washed out by flood waters bursting through the dams. Because they were so strong and durable, stone arches also were favored by railroads.

Most Connecticut stone arches used locally available material: brownstone in the Connecticut River valley, gray granite in eastern Connecticut. The elaborate urban stone arches built around 1900 sometimes made use of granite brought from other New England quarries. Brick arches, though far less common, were built on the same principle as stone.

Stone bridges could be built with locally available skills. Most communities had both carpenters, who were needed for the arched-shaped wooden forms or centerings upon which the stones were laid, and masons, who laid the stone.

## PEQUABUCK BRIDGE

- ❑ Meadow Road over Pequabuck River (bypassed)
- ❑ Farmington
- ❑ Stone arch
- ❑ Length: 22'
- ❑ Built in 1833



This brownstone arch is one of the oldest masonry bridges in the state. In 1830, a town-appointed committee studied all of Farmington's bridges and concluded that the Pequabuck River crossing needed immediate attention. At the time, Meadow Road was the princi-

pal route between Farmington village and the farms in the section then known as the Great Plain. Perhaps because the wooden spans that preceded it had fared so badly (the town had rebuilt the bridge in 1801 and again in 1819), Pequabuck Bridge was this time built in stone. Like

most town-built arches of the period, it is of rubble construction, with finely cut stone used only for the arch rings.

Construction of the bridge was coordinated with that of the Farmington Canal, which intersected Meadow Road about 450' to the east. So

that farm wagons wouldn't have to climb an extra hill, the town set two conditions: the new bridge had to be at the same height as the bridge over the canal, and the canal company had to construct a level embankment between the two bridges. A modern bridge now carries

Meadow Road over the Pequabuck River, which was rechanneled about 300' to the west. Pequabuck Bridge was listed on the National Register of Historic Places in 1984.



## MAIN STREET BRIDGE (Bridge No. 1626)

- Main Street over Whitehead Highway ☐
- Hartford ☐
- Stone arch ☐
- Length: 104' ☐
- Built in 1833 ☐
- Horatio Potter, engineer ☐
- Elias Rathbun, builder ☐



**M**uch has changed in Hartford since this large brownstone arch was completed in 1833. Originally, the bridge carried Main Street over the Little River, and it was the only connection between two separate settlements on the north and south sides. Today the stream is buried deep under-

ground and the city has completely grown up around the bridge. Instead of the river, traffic on the Whitehead Highway flows under the bridge, and the east side of the arch is obscured by the structure built in 1954 to support the Hartford Public Library. At the time it was built, the Main

Street bridge was one of the largest stone-arch spans in the country. It was designed by Horatio Potter, a mathematics professor at Washington (now Trinity) College. Potter went on to become an Episcopalian bishop. Stone mason Elias Rathbun was not so fortunate: the strain of finishing

this bridge resulted in total paralysis of one side of his body.

Even though the lower 15' of the arch is hidden by fill, the bridge's monumental character is still evident. In the words of the 1833 vote accepting the bridge, "it combines strength with elegance of

architecture, and is honorable to the town." The bridge was listed on the National Register of Historic Places in 1985.

Above right:  
**AN 1838 ENGRAVING OF THE BRIDGE SHOWING THE LITTLE OR PARK RIVER FLOWING BENEATH THE ARCH.**

## BATES AVENUE BRIDGE

- ❑ Bates Avenue over Little Dam Tavern Brook
- ❑ Putnam
- ❑ Stone arch
- ❑ Length: 16'
- ❑ Built c. 1840



**B**uilt without mortar or cut stones, Putnam's Bates Avenue bridge is an untouched example of traditional stone-arch construction at its most basic. It shows how a rural Connecticut stonemason could make a strong and serviceable bridge simply by using flat fieldstones.

Stone arches are generally found on a town's more important roads and near mill ponds, where sudden floods could destroy less durable bridges. Bates Avenue is a minor road today, but it once served as the main road between Pomfret Factory (as Putnam was known

before it became a separate town) and Thompson. In the 1840s textile manufacturer Hosea Ballou owned the property at the north end of the bridge, probably for the sake of using the small upstream pond as a reservoir for his nearby mill.

Although the exact

date of the bridge is unknown, it may well date from the time of Ballou's first mill in the early 1840s.



## **SOUTH STATE STREET BRIDGE (Bridge No. 3682)**

South State Street over Rippowam ☐  
River ☐  
Stamford ☐  
Stone Arch ☐  
Length: 3 spans of 30' ☐  
Built in 1847 ☐

**T**he New York and New Haven Railroad built this substantial masonry-arch bridge in 1847 on what would become Connecticut's most important rail corridor. Like other railroads of the period, the New York and New Haven preferred stone bridges for major crossings

because of their strength and durability; iron was not yet widely accepted as a bridge material. Trainloads of passengers and freight rolled over these arches until the early 1890s, when the New Haven Railroad moved its main line a short distance to the south as part of its four-track

expansion. The town then took over the bridge for highway use.

The bridge is an outstanding monument to the early days of railroading in Connecticut. Although modern railings and sidewalks have been added, the bridge retains much of its

historic appearance. Because of extensive rebuilding, large engineering structures from the state's first episode of railroad construction are now extremely rare.

## **VERNON TUNNEL (Bridge No. 1617)**

- ☐ Tunnel Road under former railroad embankment
- ☐ Vernon
- ☐ Stone arch
- ☐ Length: 110'
- ☐ Built in 1849



The Vernon Tunnel is another rare engineering structure from Connecticut's first generation of railroad construction. Like other railroads of the period, the Hartford, Providence and Fishkill Railroad had to accommodate numerous pre-existing rural roads when putting through their

line. While most roads simply crossed the tracks at grade, at least initially, tunnels such as this were needed when the railroad, in order to maintain a near-constant elevation for its line, constructed a high embankment. Massive ashlar masonry such as that of the Vernon Tunnel

was typical of these early railroad structures. The tunnel has outlived the rail line, which was abandoned in the late 1970s.



## **PACKERVILLE BRIDGE (Bridge No. 4754)**

Packerville Road over Mill Brook ☐  
 Plainfield ☐  
 Stone arch ☐  
 Length: 26' ☐  
 Built c. 1850 ☐

**T**he ring stones of this semicircular arch are long blocks of pink granite, forming a contrast with the rough fieldstone masonry of the sides of the bridge. Like most of the stone arches in eastern Connecticut, this one was associated with textile manufacturing. Packerville was for-

merly the site of a small cotton mill started in 1818 by Daniel Packer. A typical paternalistic manufacturer, Packer took a great interest in the little village around his mill, building the nearby church, its parsonage, and houses for mill workers. This bridge, which is located just

below the mill dam, may also have been built by the mill.

Old views of the bridge show a simple wooden rail fence in place of the present concrete roadway barriers.

## BRIDGE STREET BRIDGE (Bridge No. 1852)

- ❑ Route 32 (Bridge Street) over Willimantic River
- ❑ Windham
- ❑ Stone arch
- ❑ Length: 80'
- ❑ Built in 1868
- ❑ Lyman Jordan, builder



The 80' span of this impressive stone arch is the third longest in Connecticut, exceeded only by Hartford's Main Street and Bulkeley bridges. Its finely cut ring stones, large key-stone, and parapet coping are gray granite of a type quarried locally, and the rubble spandrels appear

to be made of stone cut from the ledge along the river banks. The builder, Willimantic stonemason Lyman Jordan, inserted a large tablet bearing his name and the date of the bridge (now worn and hard to read) in the east parapet.

The bridge formerly

stood in the midst of a large mill complex owned by the Windham Cotton Manufacturing Company, of which only a few remnants survive. Just west of the bridge was a dam that provided the waterpower for the mill. The wisdom of using stone arches for crossings located

dams was shown just one year after the Bridge Street Bridge was completed. In October 1869, heavy rains caused flooding throughout eastern Connecticut, destroyed dozens of dams and bridges, and turned the countryside into what one observer called a "vast lake." Both this

bridge and Willimantic's other stone arch (about a mile downstream at the former American Thread mills) survived intact.



## NAUBUC AVENUE BRIDGE (Bridge No. 3671)

- Naubuc Avenue over Porter Brook ☐
- Glastonbury ☐
- Stone arch ☐
- Length: 20' ☐
- Built in 1871 ☐

This is one of the best-preserved examples of the bridges built following the disastrous flood of October 1869. Swollen by heavy rains that year, rivers and streams overflowed their banks and burst through mill dams, washing away all bridges in their paths. Glastonbury was

especially hard-hit, with seventeen of the town's eighteen bridges destroyed. Over the next two years, the town built replacements, mostly of stone, which it hoped would hold up to flood waters better than wooden bridges. Instead of the usual few hundred dollars a year, Glastonbury's

bridge expenditures soared to about \$36,000 and forced the town to take out a bank loan.

The masonry in this bridge is particularly distinguished. Although the span-drels are made of rougher stone, the arch ring itself is formed from carefully

cut brownstone blocks with the faces tooled in a vermiculated pattern. Similarly finished blocks are used for the railings' thick capstones and ends, one of which bears the date "July 1, 1871" carved in raised characters.

This bridge is probably the span referred

to in town accounts as "Cove Bridge," since it was on the road to Keeney Cove. Like Glastonbury's other "Flood of 1869" bridges, it was built with local labor and materials.

## HARTFORD RAILROAD TUNNEL (Bridge No. 979)

- ☐ Main Street and Albany Avenue  
(Route 44) over Amtrak
- ☐ Hartford
- ☐ Brick arch
- ☐ Length: 300'
- ☐ Built in 1871



**C**haos and mayhem were the order of the day before Hartford's double-arched railroad tunnel was built. Wagons, carriages, horse-drawn streetcars and pedestrians had to wait for (or dodge) between 40 and 50 trains a day at this location, where two major rail lines crossed two of Hart-

ford's busiest streets at grade. Finally, the railroads built the tunnel so that trains could run beneath the city streets.

The tunnel's four-track width and 300' length made it a substantial engineering work for the time. The New York, New Haven and Hartford

Railroad designed and built the tunnel, with a smaller share of the cost borne by the Hartford, Providence and Fishkill Railroad. Its smoothly finished brownstone ashlar facing (the interior of the tunnel has brick arches), elaborate moldings and pilasters, and prominent date-

stones show that the railroads intended the tunnel to be an elegant work of architecture. A remnant of original Victorian iron railing survives above the Albany Avenue portal.

Above right:  
**DETAIL OF RAILING ON ALBANY  
AVENUE.**



## **BULKELEY BRIDGE (Bridge No. 980A)**

- Interstate 84 over Connecticut River ☐
- Hartford ☐
- Stone arch ☐
- Length: 9 spans, 1,192' overall, ☐
- 119' maximum span length
- Built in 1903-1908 ☐
- Edwin D. Graves, chief engineer ☐
- Edmund M. Wheelwright, architect ☐

34

In 1926 one of the Bulkeley Bridge's engineers speculated, probably correctly, that it was the last monumental stone bridge that would ever be built. Within a few years of its conception, concrete and steel had entirely replaced stone in the construction of large bridges. Not only was

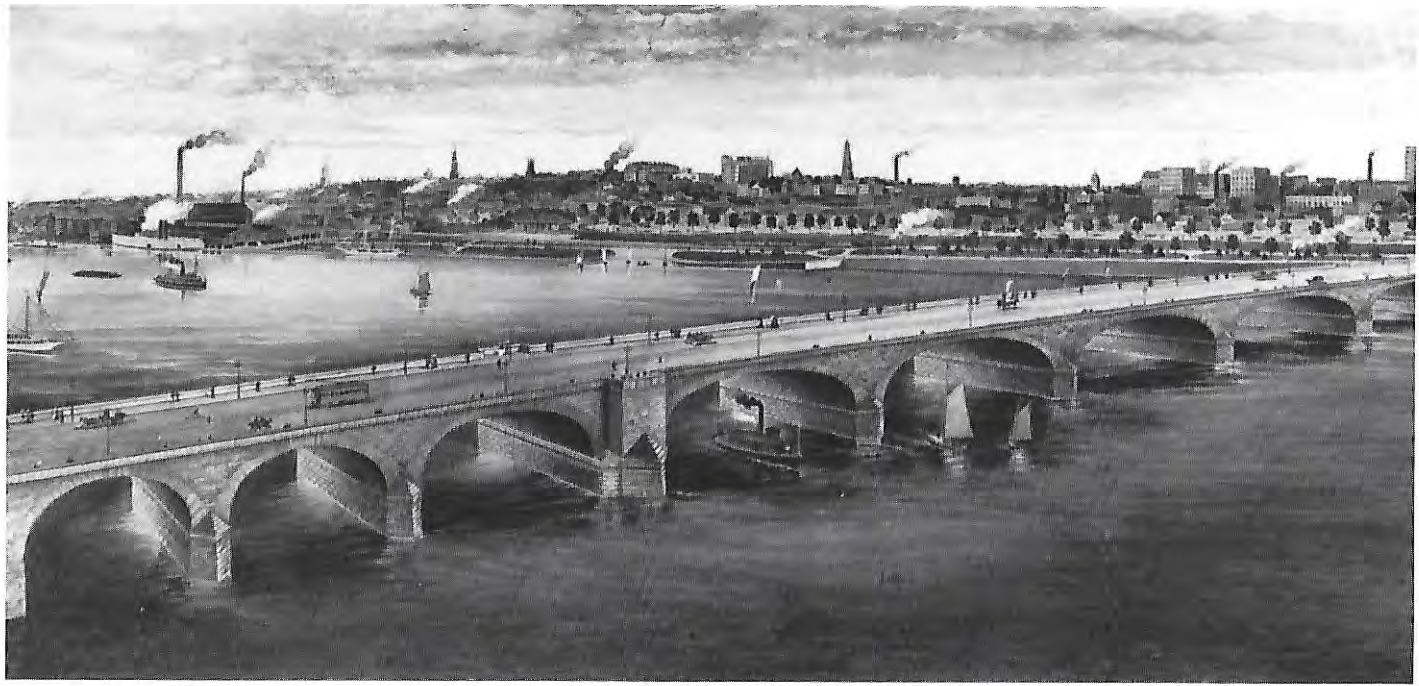
it the last of its kind, but also in many ways the Bulkeley Bridge was one of the greatest. Five of its spans are longer than any of the other stone arches in the state; 100,000 cubic yards of pink and gray granite were consumed in its construction; the tolerances for the stone-cutting were unbeliev-

ably close (less than 3/8" over the whole face of a 10-ton block); and its total cost, some \$3 million, made it for many years the most expensive bridge built in Connecticut. Four people perished during construction, and the chief engineer suffered a nervous breakdown from

which he never recovered.

The Bulkeley Bridge was built to replace Hartford's 1818 covered bridge, which burned in 1895. Hartford's civic and business leaders were determined that the new bridge would be "an ornament to the city which should

endure forever." To create a proper setting, the bridge commission tore down rows of tenements and constructed wide, landscaped approach boulevards on both sides of the river. In designing the bridge, the architect and engineer studied numerous ancient European bridges,



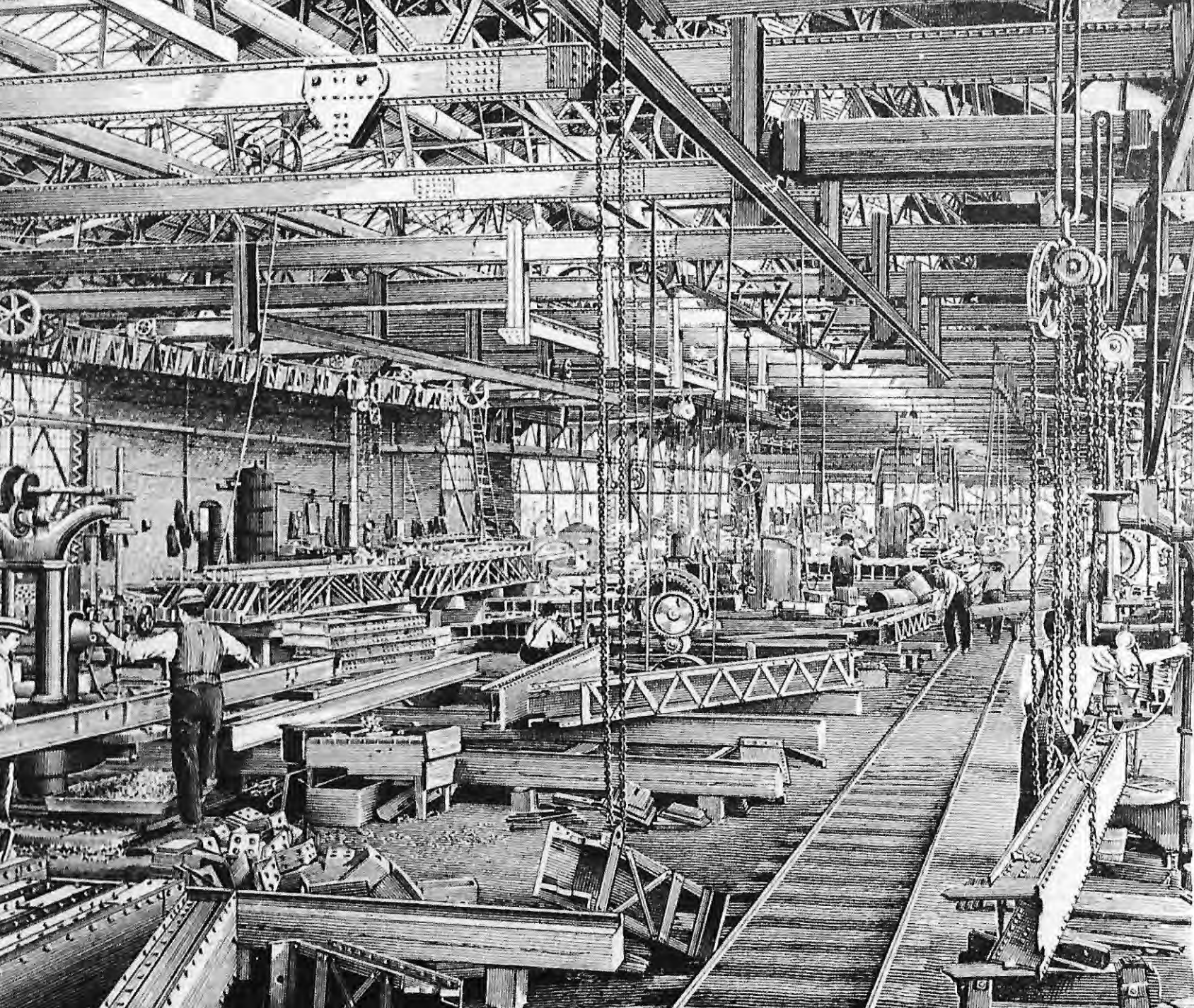
and they decided that uncomplicated geometry and restrained architectural detailing would create the proper sense of “strength, beauty and dignity.” The Bulkeley Bridge’s tremendous scale, plain but graceful lines, arched form, and simple Classical ornament make it one of the

state’s pre-eminent examples of Neo-Classical architecture. Former governor and U. S. Senator Morgan Bulkeley was an early proponent of the bridge and chairman of the special commission created by the State Legislature to oversee its construction. After his death

in 1922, the bridge, originally known simply as the Hartford Bridge, was renamed in his honor.



Above right:  
**EVERY STONE WAS INDIVIDUALLY  
 NUMBERED ACCORDING TO ITS  
 PLACE IN THE BRIDGE. ADDITIONAL  
 VIEW OF CONSTRUCTION ON P. 23.**



## IRON AND STEEL BRIDGES

Unlike timber and stone bridges, metal bridges were an industrial product. Fabricators such as Connecticut's Berlin Iron Bridge Company bought iron in basic forms—I-beams, angles, plates—and cut and riveted it together to make bridge components. The companies employed traveling agents to sell their products to local highway officials.

Once the industry was established, iron trusses dropped in price, and towns throughout America bought them as replacements for their timber bridges. Pony trusses (low trusses without overhead bracing) served for small bridges. Longer crossings required through trusses or, if the river ran in a deep gorge, a deck truss, in which the roadway ran along the top of the bridge.

Nineteenth-century engineers created a rich diversity of truss types. Although all trusses work by transmitting the roadway load to the abutments, they differed from one another in the way that their members were arranged. Some had

their diagonals resisting stretching (tensile) forces, while others had them bearing compressive forces. The various patterns were named after the engineer who devised them (Pratt, Warren, and Whipple trusses) or after the shape formed by the upper and lower chords. The lenticular (lens-shaped) truss was the specialty of Berlin Iron Bridge Company. Bridge fabricators also distinguished their products by using proprietary components, such as patented columns or connectors.

As the turn of the century approached, truss design became more standardized. A few basic patterns, with variations, sufficed where dozens had competed before. Bridges no longer relied on patented components. Riveted connections superceded the pinned joints that had characterized American trusses throughout the 19th century, and steel replaced wrought iron for structural work.

The coming of the automobile meant that highway

trusses had to be designed for increasingly heavy loads. Except for the use of ever larger and stronger members, however, only minor refinements occurred after 1900. Engineers continued to specify trusses for highway bridges until about 1940. After that, the availability of large concrete and steel beams (and the ability to transport them to any site) made trusses obsolete. Beam bridges served not only for minor town roads but also for major undertakings such as the 3,200'-long, 23-span Charter Oak Bridge, completed in Hartford in 1942.

**T**he major innovations of the 20th century were long-span steel bridges intended to provide high-level passage across wide bodies of water. Engineers designed suspension bridges, cantilevered trusses, and steel arches of ever-greater span. Connecticut, however, has only two examples of the period's high-technology steel engineering, the 600'-long arches of the Arrigoni Bridge in Middletown and the Gold Star Bridge in New London, a 540'-span deck truss built in 1943.



## PINE CREEK PARK BRIDGE

- Park road over Pine Creek ☐
- Fairfield ☐
- Wrought-iron Pratt pony truss ☐
- Length: 54' ☐
- Built 1870-1872 ☐
- J. H. Linville, engineer ☐
- Keystone Bridge Company, ☐  
fabricator

40

**T**his rare Keystone-column bridge was originally a railroad structure. Built as an approach span to an 1872 draw-bridge in Middletown, it was re-used in 1890 to carry Mill Hill Road in Fairfield over the tracks of the New Haven Railroad. In 1979, the bridge was relocated to a town-

owned conservation area.

Its compression members are octagonal columns patented by the Keystone Bridge Company of Pittsburgh. The Keystone column consists of four rolled segments riveted together through cylindrical spacers. Because the

spacers are graduated in length, the columns are thicker in the middle than at the ends. According to the company, this gap allowed the interior of the column to be inspected; in some of their bridges, the gap was used to allow diagonal tie rods to pass through the uprights without the

need for special fixtures. Principally, however, the gap represented an easy way to make a tapered wrought-iron column that was similar to the cast-iron columns the company used in other bridges.

Although it soon ceased using its patented columns, the

Keystone Bridge Company continued as one of the country's largest bridge fabricators until 1900, when it was absorbed by the American Bridge Company.

## RIVERSIDE AVENUE BRIDGE (Bridge No. 3845)

- ❑ Riverside Avenue over Metro North railroad
- ❑ Greenwich
- ❑ Cast and wrought-iron Whipple through truss
- ❑ Length: 168'
- ❑ Built in 1871
- ❑ Francis C. Lowthorp, engineer
- ❑ Keystone Bridge Company, fabricator



41

Riverside Avenue Bridge is the only surviving bridge in Connecticut (and one of only about a dozen in the entire country) that has major structural members made of cast iron. Cast iron was widely used in trusses up until the early 1870s. Because it breaks under tension (bending or

stretching forces), cast iron is only suitable for compression members, such as the hollow tubes that make up the top chord and verticals of this bridge. In contrast, wrought iron, which is produced by rolling hot metal under pressure, could be used either in tension or in compression.

As the American iron industry matured, wrought iron became more widely available, and after several disasters involving improperly engineered bridges that were part cast-iron, wrought iron totally superseded the earlier material for use in bridges.

Riverside Avenue Bridge incorporates several other archaic features. The form of the bridge is based on a truss shown in Squire Whipple's pioneering *Treatise on Bridgebuilding*, published in 1847. The Whipple truss, which has diagonal tension members running across two panels,

was popular with early engineers. The bridge also illustrates the specialized connections characteristic of early trusses. The cast-iron lower-chord junction boxes and the ribbed blocks through which the diagonal rods pass were two improvements on the Whipple truss patented by



engineer Francis C. Lowthorp.

Riverside Avenue Bridge was originally part of a multi-span railroad bridge crossing the Housatonic River. When the New Haven Railroad replaced the bridge in 1888, it salvaged several spans for re-use as highway overpass-

cs. Riverside Avenue Bridge was erected in its present location about 1895. It was listed on the National Register of Historic Places in 1977.



## WASHINGTON AVENUE BRIDGE (Bridge No. 4534)

- ❑ Washington Avenue over Mad River
- ❑ Waterbury
- ❑ Wrought-iron lenticular pony truss
- ❑ Length: 63'
- ❑ Built in 1878
- ❑ Corrugated Metal Company, fabricator



This bridge was constructed in 1878, the year that Corrugated Metal Company of East Berlin, Connecticut, began making bridges. It is one of only two known surviving bridges from this important fabricator's first year.

Bridge fabrication

saved Corrugated Metal Company from bankruptcy. The company's business in metal roofing, roof trusses, and fire-proof shutters was failing in 1877, when engineer William O. Douglas joined the firm. Douglas, a graduate of the U. S. Military Academy, had devised an un-

usual truss with curved top and bottom chords. The lenticular or parabolic truss, which Douglas patented in 1878, quickly became a success. The Corrugated Metal Company, known after 1883 as Berlin Iron Bridge Company, claimed to have built more than ninety percent of the

highway bridges in New England in the period 1878-1888. Waterbury alone bought more than a dozen Berlin bridges.

Although a modern beam structure now bears the weight of traffic, the distinctive profile of the bridge's lenticular truss is clearly visible. Also,

the bridge retains its original lattice railing. Its orb finials and cast-iron rosettes appeared on Corrugated Metal and Berlin Iron Bridge Company bridges through the 1890s.



## CHAPEL STREET WEST RIVER BRIDGE (Bridge No. 3806)

- Chapel Street over West River ☐
- New Haven ☐
- Wrought-iron Pratt pony truss ☐
- Length: 98' ☐
- Built in 1882 ☐
- Charles E. Fowler, engineer ☐
- Corrugated Metal Company, ☐
- fabricator

44

Although most of the bridges built by Corrugated Metal Company utilized its patented lenticular truss, the firm's East Berlin shop also fabricated trusses designed by other engineers, such as those working for railroads or the state's larger cities. This bridge was

designed by Charles E. Fowler, the New Haven City Engineer. Its pinned connections, light members (the top chord is only 6" deep), and use of nonstandard structural members (such as open-web floor beams) exemplify 1880s truss engineering. Victorian flourishes such as the elab-

orate cast and wrought-iron sidewalk railing helped relieve the utilitarian appearance of the bridge. The bridge is located in Edgewood Park, part of New Haven's first planned green belt.

## GLEN FALLS BRIDGE and RIVER STREET BRIDGE (Bridge Nos. 4402 & 4403)

- ❑ Brunswick Avenue and River Street over Moosup River
- ❑ Plainfield
- ❑ Wrought-iron lenticular through trusses
- ❑ Length: 120' (Glen Falls), 101' (River Street)
- ❑ Built in 1886
- ❑ Berlin Iron Bridge Company, fabricator



Of the hundreds of lenticular-truss bridges built by Berlin Iron Bridge Company in Connecticut, fewer than a dozen survive, and only four of the larger through trusses.

The two oldest through trusses are in Plainfield and are nearly identical

except for their length. In addition to the lenticular configuration, they have the pinned connections, tapered floor beams, and U-shaped floor-beam hangers (called "hairpins") that were part of Berlin Iron Bridge's design. In addition, both bridges incorporate two refinements patented

in 1885: mid-level longitudinal tie rods and inclined struts between the end post and the first lower joint.

Although its portal was modified to provide greater clearance, Glen Falls Bridge (now closed to traffic) retains two features found in few

other surviving lenticular trusses: a wooden deck and a cast-iron date plate affixed to the top of one portal joint.

Both bridges were built following the flood of February 1886, which destroyed nearly every bridge in Plainfield. The town had to borrow money

to pay for replacements, which included three from Berlin Iron Bridge. Probably because of the emergency, the bridges lack the ornamental portals and railings found on other trusses of the period.

GLEN FALLS BRIDGE (left)  
RIVER STREET BRIDGE (right)



## BOARDMAN'S BRIDGE and LOVERS LEAP BRIDGE

- Boardman Road and Pumpkin Hill ☐
- Road over Housatonic River
- New Milford ☐
- Wrought-iron lenticular through ☐
- trusses
- Length: 188' (Boardman), ☐
- 173' (Lovers Leap)
- Built in 1888 (Boardman) ☐
- and 1895 (Lovers Leap)
- Berlin Iron Bridge Company, fabricator ☐

46

Connecticut's other two remaining lenticular through trusses cross the Housatonic River in New Milford. Although both are of similar length and were built only seven years apart, they are not identical. The builder's plates, which are inscribed with the names of the

selectmen as well as the date and Berlin Iron Bridge Company, are different designs, and the winged finials on Boardman's Bridge are more elaborate than the urns on Lovers Leap. The bridges, which are among the largest built by the company, differ in structural details as well.

Lovers Leap Bridge uses lattice-girder hangers to suspend the floor beams from the lower chord, whereas Boardman's uses the more common "hairpins."

Their distinctive truss design was part of the reason Berlin Iron Bridge Company was so successful in deal-

ing with local highway officials. Although the lenticular truss was in fact strong and economical, Berlin agents frequently exaggerated its qualities in comparing it with rival designs. At the same time, lenticular bridges must have given satisfaction. Many towns, like New Milford,

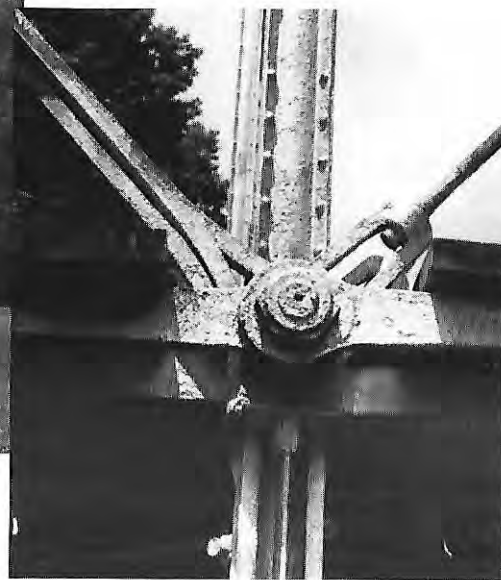
repeatedly did business with Berlin Iron Bridge Company as they replaced their old timber bridges.

The bridges are now bypassed with modern structures. Both were listed on the National Register of Historic Places in 1976.

**BOARDMAN'S BRIDGE** (left)  
**LOVERS LEAP BRIDGE** (right)

## SANDY HOOK IRON BRIDGE

- ❑ Abandoned road over Poquatuck River
- ❑ Newtown
- ❑ Wrought-iron Pratt through truss
- ❑ Length: 120'
- ❑ Built in 1890
- ❑ Dean & Westbrook, builder



Just as Berlin Iron Bridge Company had its lenticular truss to distinguish it from its competitors, so too the New York City engineering firm of Dean & Westbrook used a distinctive component, Phenix columns, to set their bridges apart. Phenix columns were made of rolled quarter-circle

segments riveted together along exterior flanges. Patented by Philadelphia's Phenix Iron Company in the 1860s, they were used extensively in factory construction and later for bridges. Like other unusual structural members, Phenix columns required specialized connectors to

join the columns together and to provide anchorages for the eyebars and tie-rods that make up the diagonals and lower chord.

Other typically Victorian features of this pin-connected bridge include the fancy builder's plates and the sunburst decora-

tion on the portal bracing, both distinctive to Dean & Westbrook. Because this bridge has long been out of service, it retains many original features, such as pipe railings and a wood-plank floor, that have been replaced on most other 19th-century trusses.



## HALES ROAD BRIDGE (Bridge No. 3852)

- Hales Road over Metro North ☐
- Westport ☐
- Steel Warren pony truss ☐
- Length: 53' ☐
- Built in 1891 ☐

**H**ales Road Bridge was built as part of the New Haven Railroad's upgrading of its New York to New Haven corridor in the early 1890s. That project required scores of new bridges to carry local highways over the rail line, but only four, including Hales Road Bridge, remain.

These bridges, which are the oldest riveted trusses in Connecticut, represent one of the first large-scale programs of riveted highway-bridge construction. Compared with the pinned technique that dominated American bridge-building at the time, riveted joints offered greater rigidity and

simplified connections. With improvements in field-riveting, riveted trusses could be assembled as easily as pinned bridges.

Although the Warren-truss pattern, use of steel, and riveted connections in Hales Road Bridge prefigure the small highway

bridges of the 20th century, its details depart from what became standard engineering practice. Among its unusual features are the bent-bar interior lattice on the underside of the top chord, the direct riveting of components rather than using gusset plates, and flat bars instead

of angles for the uprights. Each of these items saved the railroad money and was adequate to meet the bridge's load-bearing requirements. Such details, however, reflect an experimental stage in riveted truss design.

## TALCOTTVILLE MAIN STREET BRIDGE (Bridge No. 4575)

- ❑ Main Street Talcottville over Tankerhoasen River
- ❑ Vernon
- ❑ Wrought-iron lenticular pony truss
- ❑ Length: 58'
- ❑ Built in 1891
- ❑ Berlin Iron Bridge Company, fabricator



Talcottville's Main Street bridge is one of the best preserved of about a half-dozen lenticular pony trusses left in the state. It also is unusual in that it continues to function as a truss; most of the others are now supported on secondary structural systems such as I-beams.

The bridge is typical of Berlin Iron Bridge Company's smaller spans. In addition to its lenticular form, the bridge exhibits characteristic Berlin Bridge features such as the use of tapered uprights, floor beams that are deeper in the center than at the ends, "hairpin" hangers connecting the

beams to the lower-chord joints, and the company's distinctive lattice railing with cast-iron rosettes. Only one orb-shaped finial remains as portal decoration, but presumably such finials graced the other corners of the bridge as well.

Today Main Street is

a cul-de-sac cut off by Interstate 84. When this bridge was built, however, Main Street was an important road connecting the bustling mill village of Talcottville with Manchester and other parts of Vernon.



## **DRAKE HILL ROAD BRIDGE**

- Former Drake Hill Road over ☐
- Farmington River ☐
- Simsbury ☐
- Wrought iron and steel ☐
- Parker through truss ☐
- Length: 183' ☐
- Built in 1892 ☐
- J. E. Buddington, engineer ☐

50

Now bypassed by a modern bridge to the north, Drake Hill Road Bridge is a typical 19th-century highway truss. It has pinned connections, and its narrow roadway shows that it was designed in an age before motor vehicles were a consideration. In form, it is a Parker truss, a Pratt truss in

which the top chord is curved to make the truss deeper in the middle. The Parker design was used extensively for long spans.

The bridge was designed, manufactured and erected by controversial New Haven engineer John E. Buddington. From

the time of his graduation from Yale's Sheffield Scientific School in 1877, Buddington publicly attacked the work of other bridge engineers and promoted his own ideas. He worked for a time for the New Haven Railroad (whose engineering he had criticized as a student) and Berlin

Iron Bridge Company, before starting his own firm in the 1890s. Many of the details of this bridge are highly unusual. Buddington's originality appears in such eccentricities as the use of cast-iron spacer spools and the original floor system, now modified, in which closely spaced cross

beams were supported directly from the lower chord. The bridge was listed on the National Register of Historic Places in 1984.

## TOWN BRIDGE ROAD BRIDGE (Bridge No. 5222)

- ❑ Town Bridge Road over Farmington River
- ❑ Canton
- ❑ Wrought-iron Parker through truss
- ❑ Length: 160'
- ❑ Built in 1895
- ❑ Berlin Iron Bridge Company, fabricator



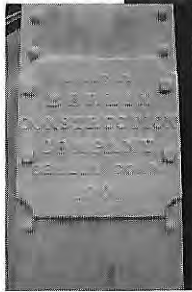
In a rare departure from its trademark lenticular design, the Berlin Iron Bridge Company supplied a Parker truss, the conventional choice for spans of this length, for the Town of Canton's bridge across the Farmington River. The bridge is unusual in another respect: it combines

riveted and pinned connections. Box-section members such as the top chord, uprights and center diagonals are riveted together using small gusset plates, but the eyebars that make up the other diagonals are secured by pins. Although engineers debated the merits of pinned versus riveted

construction in terms of safety, rigidity and economics, this bridge suggests that the choice was also partly a matter of convenience in design.

Despite some missing cresting, the bridge's Victorian-style decorative features are unusually complete, including urn finials,

curved portal braces, builder's plate and ornamental railings.



## MT. HOPE BRIDGE (Bridge No. 4727)

- Mt. Hope Road over Mt. Hope River ☐
- Mansfield ☐
- Steel Warren pony truss ☐
- Length: 69' ☐
- Built in 1901 ☐
- Berlin Iron Bridge Company, ☐
- fabricator

52

**M**ansfield's Mt. Hope Bridge is a well-preserved example of early 20th-century bridge construction. Its one-lane width and light members (the top chord measures only 5 1/2" x 12" in section) are typical of an age when traffic consisted mostly of horse-drawn carriages and farm wag-

ons. The bridge's riveted connections, use of steel, and Warren truss pattern demonstrate the standardization in bridge building that had occurred by 1900.

The bridge is also notable as one of the first bridges produced by Berlin Construction Company. In

1900 the American Bridge Company had acquired the Berlin Iron Bridge Company, along with more than two dozen other firms, in an attempt to monopolize the industry. The following year several former officials of Berlin Iron Bridge left the larger company to start their own firm.

They built a new plant in Berlin close to the main rail line, renewed their contacts with local highway officials and began making bridges.

Berlin Construction Company soon became a major regional producer of bridges, as well fabricating

structural steel for factories and commercial buildings.

## BRIDGE NO. 507

- ❑ Glen Road (Route 816) over Housatonic River
- ❑ Newtown - Southbury
- ❑ Steel Parker through truss
- ❑ Length: 300'
- ❑ Built in 1934
- ❑ Connecticut Highway Department, engineers



The State Highway Department built several long-span trusses in the 1930s. Where the terrain was fairly flat and river conditions made construction of intermediate piers difficult, state engineers chose large trusses rather than open-spandrel concrete arches or multiple spans. The

Parker truss was a common choice for bridges of this length. The curved top chord gave the truss greater depth in the middle, where it was needed most, and thus saved material over a straight-chord Pratt truss of comparable size. The Parker truss was, however, somewhat more com-

plicated to engineer and fabricate.

The bridge was built as part of the State Highway Department's ongoing trunk-line improvement program. Prior to the construction of Interstate 84, Glen Road carried Route 6, one of the state's major inland east-west

routes. The traffic on Route 6, including large numbers of trucks, was second only to the shoreline Post Road. Only a substantial bridge such as this could suffice for Route 6's Housatonic River crossing.



## BRIDGE NO. 1415

- Route 169 over Shetucket River ☐
- Norwich-Lisbon ☐
- Steel Pratt deck truss ☐
- Length: 2 spans, 269' ☐
- overall, 126' maximum span length
- Built in 1938 ☐
- Connecticut Highway Department, ☐
- engineers

**B**ridge No. 1415 was begun immediately after the Hurricane of September 1938 destroyed the previous bridge at the site. That storm, one of the deadliest in the state's history, ruined fifty bridges. With the help of the federal government, the State Highway Department replaced them all in a

little more than a year. This bridge cost over \$111,000 and was one of eleven that were partly funded by the federal Public Works Administration.

The bridge is typical of the State Highway Department's trusses of the 1930s. The size of the structural

members, the large rivet plates and the concrete slab deck show that it was designed to meet the ever-increasing needs of motor vehicle traffic. The railing, which consists of tubular rails, twisted metal bars and concrete piers, hints at an Art-Deco influence. This type of

railing was one of the State's standard designs in that period.

## **CHARLES J. ARRIGONI BRIDGE (Bridge No. 524)**

- ❑ Routes 66 and 17 over Connecticut River
- ❑ Middletown - Portland
- ❑ Steel through arch
- ❑ Length: 3,428' overall, two 600' arch spans
- ❑ Built 1936-1938
- ❑ Bethlehem Steel Company, fabricator



**A**t the time of its completion, the Arrigoni Bridge was the largest and most expensive bridge built in Connecticut, costing \$3.5 million. Even today its two 600' arches have the longest span length of any bridge in the state. The choice of large steel through arches for this loca-

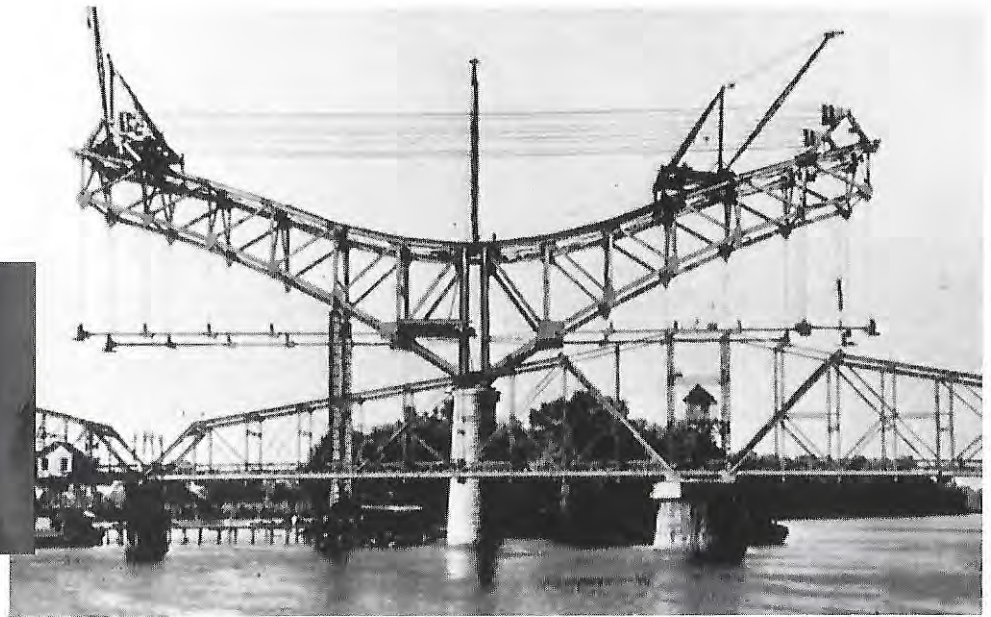
tion, with the roadway suspended from the arches by cables, allowed wide navigation channels on the river, minimized pier construction, and provided a profile to the bridge that was aesthetically pleasing. By replacing a draw-bridge with a high-level crossing (the bridge provides more

than 90' of clearance above the river), the Arrigoni Bridge foreshadowed all subsequent major highway crossings of Connecticut's navigable rivers.

From a technical standpoint, the bridge exemplifies the long-span bridge engineering of the first half of the 20th century.

Because of the growing need to provide uninterrupted highway passage over large bodies of water, engineers increasingly were called upon to design large cantilevered trusses, suspension bridges, and steel arches. Innovative erection methods, the availability of very large structural com-

ponents, and special metals all contributed to the development of long-span bridge technology. For example, nearly a third of the Arrigoni Bridge utilized high-strength silicon steel, and the bridge was almost entirely erected by building the arches outward from the center pier, letting them



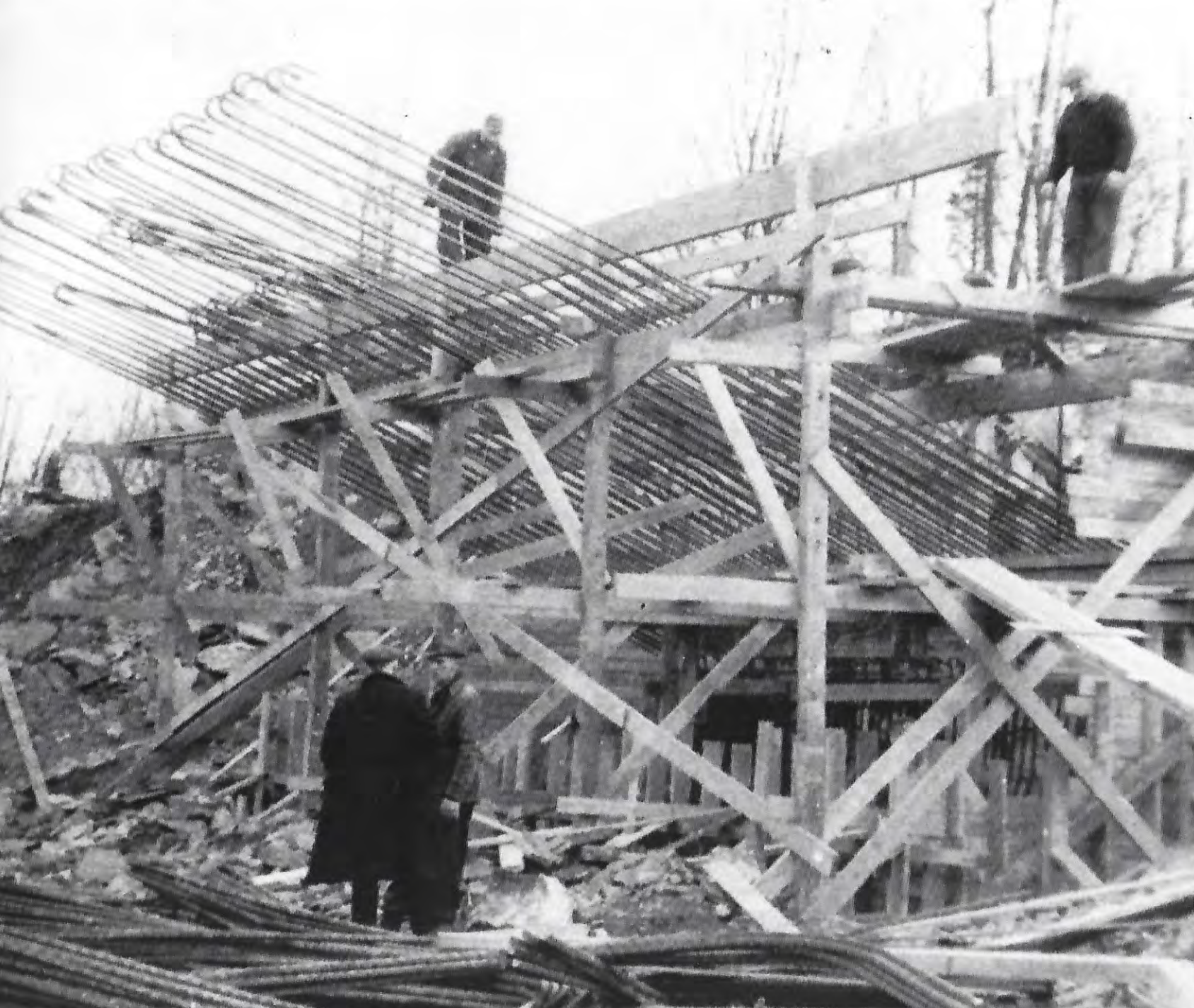
balance each other as they were extended over the water. Another notable engineering feature are the chains of huge eye-bars under the roadway that tie together the ends of each arch; the tied-arch technique resisted the outward horizontal thrust of the arches and thus allowed the

piers to be much smaller and more economical.

The Arrigoni Bridge, named for the state legislator who promoted the project, was designed by Leslie G. Sumner of the State Highway Department and William G. Grove of the American Bridge Company.

The eminent New York firm of Robinson and Steinman served as consulting engineers. The bridge won the American Institute of Steel Construction's First Prize in the large bridge category in 1938.

Above left:  
UPPER ENDS OF SUSPENDER  
CABLES.



Concrete is a mixture of sand, stone and cement that hardens into a rock-like mass when mixed with water. Although known to the ancient Romans, concrete was not widely used for bridges until methods of reinforcing it with steel were developed. Like stone, concrete has tremendous resistance to compressive forces but relatively little tensile strength. Imbedding steel in the concrete, however, gives it tensile strength as well.

The first reinforced-concrete bridge in America was built in 1889, but the material remained in an experimental phase until the early 1900s. Bridge engineers found that varying the proportions of the ingredients affected the strength of the concrete, and they tried several methods of reinforcement, including steel beams, twisted bar and cable, before settling on the ridged rod still in use today.

Reinforced concrete had many advantages. The material itself was inexpensive, consisting mostly of locally available sand and stone. Since con-

crete was also being introduced for dams, roads and buildings in the early 1900s, many Connecticut contractors quickly gained experience working with the new material. Concrete also promised lower maintenance costs compared with metal trusses, which required frequent painting and replacement of rusted components. The State Highway Department recommended concrete for town bridge construction and built most of its own early bridges using concrete.

Not all reinforced-concrete bridges were arches. Most of Connecticut's bridges from the 1920s and 1930s consisted of a single thick slab or a series of concrete beams. Arches, however, were used for the State's larger bridge projects and for the many "City Beautiful" bridges erected in urban areas in the early 20th century.

## NORTH MAIN STREET BRIDGE (Bridge No. 3651)

- ❑ North Main Street over Trout Brook
- ❑ West Hartford
- ❑ Concrete arch
- ❑ Length: 3 spans, 78' overall, 15' maximum span length
- ❑ Built in 1901
- ❑ A. B. Alderson, engineer



59

This small, plainly detailed bridge has the distinction of being the oldest remaining concrete bridge in Connecticut. It was one of a series of bridges, all concrete, built by the Town of West Hartford under the direction of local engineer Algernon B. Alderson. Concrete con-

struction was still in its infancy when this bridge was built. There was yet no agreement on the proper mixture of cement, sand, and stone, and engineers argued over the type of reinforcing steel and the best way to lay the reinforcement to make the strongest bridge.

This bridge contributed to the advancement of concrete bridge construction in Connecticut when it appeared in the *Proceedings of the Connecticut Society of Civil Engineers* as an example of a high-strength concrete mixture. An engineer for the contractor, Hartford Paving and Con-

struction Company, noted that it had the longest, shallowest arches that his company had ever built without using reinforcing steel. Although a modest structure, the bridge deserves respect as a pioneer of what would become the 20th century's most important bridge material.



## **BURNSIDE BRIDGE (Bridge No. 4496)**

- Forbes Street over Hockanum River ☐
- East Hartford ☐
- Concrete arch ☐
- Length: 92' ☐
- Built in 1903 ☐
- C. Henry Olmsted, engineer ☐

The shallow-arched profile of East Hartford's Burnside Bridge illustrates the engineering possibilities of reinforced-concrete: such a shape would have been virtually impossible with a stone arch. The bridge appears to have been built on the Melan system of reinforcement, an early

method which used arched steel girders imbedded within the concrete. It was designed by East Hartford engineer C. Henry Olmsted.

The bridge is also significant as Connecticut's first example of a "City Beautiful" bridge. Its graceful lines and granite-

ashlar exterior show that it was intended to be aesthetically pleasing as well as functional. Forbes Street was formerly a major road leading to Burnside, a neighborhood undergoing rapid growth in the early 20th century.

## COURT STREET RAILROAD BRIDGE (Bridge No. 3873)

- ❑ Court Street over railroad
- ❑ New Haven
- ❑ Concrete arch
- ❑ Length: 4 spans, 136' overall, 32' maximum span length
- ❑ Built in 1907



Just as railroads had pioneered iron bridges in the 19th century, so too railroads were among the first in Connecticut to make substantial use of reinforced concrete as a bridge material. The Court Street bridge is one of five similar structures built by the New Haven Railroad as

part of the reconstruction of its main line north of New Haven station. The New Haven Cut, as it was known, ran below the level of the city's streets, so the project required numerous bridges.

Reinforced concrete was still a new technique in 1907. The

reinforcing in these plainly detailed arches is not the standard steel bar in use today, but rather T-rail salvaged from train tracks and assembled into self-supporting arches prior to the pouring of the concrete.



## **EDGEWOOD AVENUE BRIDGE (Bridge No. 3608)**

- Edgewood Avenue over West River ☐
- New Haven ☐
- Concrete arch ☐
- Length: 3 spans, 192' overall, ☐
- 55' maximum span length ☐
- Built in 1910 ☐

**E**dgewood Avenue Bridge is the centerpiece of an extensive, designed landscape that includes a divided boulevard leading up to the bridge, a stretch of wooded parkland along the West River and a planned residential neighborhood on the surrounding streets. Developed in

the late 19th and early 20th centuries, Edgewood was the first comprehensively planned area in New Haven. The bridge's wide roadway, ornate portals, and elegant railing make it a fitting gateway to Edgewood. The bridge also provides a visual link between Edgewood Avenue and the

park, whose riverside drives are bordered by similar balustrades as they pass under the bridge.

Edgewood Avenue Bridge is notable as one of the earliest Connecticut bridges to make full use of the decorative possibilities of concrete. Since it is poured in place,

concrete can take any shape. Details such as this bridge's acorn finials, urn-shaped balusters and paneled surfaces, which would be exorbitant to execute in stone, could be accomplished relatively inexpensively in concrete, since the molds and formwork could be used repeatedly. Although cities

continued to build bridges with decorative stonework, Edgewood Avenue Bridge demonstrated that dignity and elegance could also be created with concrete.

## WHITEMORE MEMORIAL BRIDGE (Bridge No. 4214)

- ❑ Maple Avenue over Naugatuck River
- ❑ Naugatuck
- ❑ Concrete arch
- ❑ Length: 3 spans, 180' overall,  
66' maximum span length
- ❑ Built in 1912
- ❑ Henry Bacon, designer



The citizens of Naugatuck built this handsome bridge to honor John H. Whittemore, who died in 1910. Whittemore was the head of one of the city's largest industries, the Naugatuck Malleable Iron Company, and he used his great wealth to benefit the community. Among

his gifts were two schools and a library, all elegant buildings designed by New York architects McKim, Mead and White. A bridge was chosen as his memorial because it would combine the attributes of practicality and beauty associated with Whittemore's philanthropy. The plans for

the bridge were drawn by Henry Bacon, a nationally prominent architect best known today for the Jefferson Memorial in Washington, D.C. (1922). Bacon's design was applauded as "a monument to the memory of Naugatuck's most public spirited benefactor . . . a fitting tribute to

him who has made our abiding place a city beautiful."



## **BERLIN STREET BRIDGE (Bridge No. 4536)**

- Berlin Street over Coginchaug River ☐  
(closed)
- Middletown ☐
- Open-spandrel concrete arch ☐
- Length: 55' ☐
- Built in 1918 ☐
- Connecticut State Highway ☐  
Department, engineers

**N**ow becoming overgrown with vegetation, Middletown's Berlin Street Bridge is the oldest example of open-spandrel concrete-arch construction in Connecticut and the first use of the technique by the staff of the State Highway Department. The bridge was bypassed

by Route 72 in 1974. It retains its original arched-panel railing, a typical early 20th-century decorative treatment.

Open-spandrel concrete arches were most frequently used for exceptionally long or high crossings, where they offered significant savings

over filled arches. By eliminating the spandrel wall and roadway fill, the design allowed the use of smaller footings and thinner arch rings. The design also had the advantage of a soaring, graceful appearance. The Berlin Street Bridge in Middletown is somewhat unusual because of its

relatively small size and because it was built with a single arch barrel rather than separate ribs. After completing this prototype, the Highway Department went on to build several much larger open-spandrel projects in the 1920s and 1930s.

## **DERBY-SHELTON BRIDGE (Bridge No. 1659)**

- ❑ Bridge Street over Housatonic River
- ❑ Derby - Shelton
- ❑ Concrete arch
- ❑ Length: 5 spans, 466' overall,  
94' maximum span length
- ❑ Built in 1918
- ❑ Connecticut Highway  
Department, engineers



The Derby-Shelton Bridge was the second major bridge project completed by the State Highway Department. After the Department was given authority over the state's bridges in 1915, its engineers immediately turned their attention to the shoreline Post Road (now U.S. 1), com-

pleting the state's first bridge in 1917. At the same time, the Department began planning the replacement of the 1891 bridge that connected the cities of Derby and Shelton, both of which were undergoing explosive industrial growth as a result of World War I. The bridge was designed

with especially heavy loads in mind, such as trucks loaded with industrial materials and streetcar work trains (the bridge formerly carried two sets of trolley tracks in addition to the vehicular lanes). The Derby-Shelton Bridge set the tone for much of the state's bridge program in the 1920s

and 1930s: preference for concrete construction, the use of arches for long crossings, and standard details such as the paneled railing finished with rough-textured concrete in the recesses.



## WEST MAIN STREET BRIDGE (Bridge No. 1117)

- West Main Street over ☐
- Naugatuck River ☐
- Waterbury ☐
- Concrete arch ☐
- Length: 3 spans, 194' overall, ☐
- 64' maximum span length ☐
- Built in 1922 ☐
- Robert A. Cairns, engineer ☐

66

Few cities were as heavily influenced by the "City Beautiful" movement as Waterbury. In 1910 an entire neighborhood was torn down and rebuilt to provide the proper setting for the city's railroad station, and over the next several years civic leaders created an institutional core

that included a new city hall, central fire station, and social services building, as well as new headquarters for the brass manufacturing companies that dominated the city's economy.

At the same time, the city rebuilt many of its bridges with graceful, handsomely

detailed arches. The West Main Street bridge, for example, replaced an old iron truss, which was then re-used in a more out-of-the-way location. The bridge is a model of Neo-Classicism, with its simple pilasters, stringcourses, raised arch rings and granite railings creating a dignified

appearance. In order not to ruin views of the bridge and river, City Engineer Robert Cairns designed conduits for electrical wires and other utilities beneath the bridge's sidewalks. While the bridge was still being designed, prominent manufacturer Irving H. Chase donated a 600'-long

strip of land on the west bank to provide a park-like setting for the new structure.

## PUTNAM MEMORIAL BRIDGE (Bridge No. 992)

- ❑ Route 44 over Quinebaug River
- ❑ Putnam
- ❑ Concrete arch
- ❑ Length: 70'
- ❑ Built in 1925
- ❑ Connecticut Highway Department, engineers



The State originally planned to build a much plainer bridge at Putnam's Cargill Falls as part of its trunk-road bridge program, but local citizens felt that a more stylish bridge, especially if it were dedicated to war veterans, was needed for this prominent downtown location. As one

resident expressed it, "That bridge may be there for the next century. Why should it not have lines of grace, as well as strength?" Consequently, the citizens of Putnam appropriated \$9,000 to reimburse the state for the extra expense of sidewalks, a wider roadway, and attractive

brass lamps. They also paid more than \$2,000 for the memorial bronzes, which depict infantry, aircraft, and naval vessels and list the names of the town's World War I veterans.

The bridge was dedicated on Armistice Day, 1925, by Governor John Trumbull.

The celebration included a parade that attracted 15,000 people, at that time the largest ever held in Putnam. The event was filmed and appeared shortly thereafter in movie-house newsreels across the country.



## DIANA'S POOL BRIDGE (Bridge No. 1537)

Route 198 over Natchaug River ☐  
 Chaplin ☐  
 Concrete arch ☐  
 Length: 75' ☐  
 Built in 1926 ☐  
 Connecticut Highway Department, ☐  
 engineers

The aesthetic qualities of this large concrete arch, well-known to area fishermen and picnickers, complement the rocky ledge, wooded banks, and rushing waters of Diana's Pool. The bridge's raised arch ring, keystone, and paneled spandrels illustrate the State Highway Depart-

ment's interest in exploring the ornamental potential of concrete, especially in scenic locations such as this. Although larger than most, it is a typical, well-preserved example of the Department's early 20th-century bridge program.

## BRIDGE NO. 963

- ☐ Route 41 over Sage Ravine Brook
- ☐ Salisbury
- ☐ Concrete arch
- ☐ Length: 35'
- ☐ Built in 1929
- ☐ Connecticut Highway Department, engineers



The natural beauty of this deep, wooded ravine must have called out to the State Highway Department engineers who designed Bridge No. 963. In addition to employing an arched form, they detailed the spandrels and abutments with three sizes of plain circular disks, making

unique an otherwise standard early 20th-century concrete arch. The dramatic geometric motif foreshadowed the Department's parkway bridges of the 1930s.



## BRIDGE NO. 560

- Routes 4 and 7 over Housatonic River ☐
- Cornwall ☐
- Open-spandrel concrete arch ☐
- Length: 8 spans, 674' overall, 184' maximum span length ☐
- Built in 1930 ☐
- Connecticut Highway Department, engineers ☐

70

Soaring high above the Housatonic valley, Bridge No. 560 is an impressive example of open-spandrel concrete arch construction. It superseded a wooden covered bridge (washed away in 1936) that carried River Road across the Housatonic River at a much lower level.

The use of large arches allowed the Highway Department to solve several problems at once. By spanning the entire valley, the project provided a wider, stronger crossing safe from flood waters. It also bypassed the built-up part of the village of Cornwall Bridge, eliminated a

railroad grade crossing, and allowed for improved interchanges between local roads and the two state highways carried by the bridge.

Open-spandrel arches were ideally suited for situations like this one. For large bridges, they offered great savings in mate-

rial over filled arches. And unlike deck trusses, they did not require high piers between the spans, since the arches themselves provided the rise. This is the largest of a half-dozen open-spandrel concrete arches built by the State Highway Department in the early 20th century.



## MERRITT PARKWAY BRIDGES

Completed in 1940, the Merritt Parkway stands as Connecticut's greatest Depression-era public works project. The Parkway cost \$21 million, employed over 2,000 workers, and took six years to complete. It was originally intended as a way of reducing traffic congestion on the shoreline Post Road (now U.S. Route 1), and in fact State Highway Department planners initially called it the "Parallel Post Road." By the time construction started in 1934, however, the road had become more than just a highway. It was to be a planned landscape, 38 miles long, allowing motorists to drive from the Housatonic River in Stratford to the New York state line in Greenwich unencumbered by commercial traffic or unsightly roadside development. To make driving the route pleasurable, the Department's staff lined the roadway with plantings of native trees and shrubs, leaving vistas of rolling farmland open to view. The Parkway was named for Congressman Schuyler Merritt, one of the road's earliest and most persistent advocates.

In order to fulfill its purpose, the Parkway had to be a limited-access highway without intersections at grade. As a consequence, more than 70 bridges were built to carry the Parkway over and under local roads. In addition to being functional, the bridges were intended to become part of the scenic experience enjoyed by Parkway motorists. Staff architect George Dunkelburger produced a variety of picturesque, Neo-Classical, and Modernistic designs for the bridges. Although no two bridges are exactly alike, many motifs are repeated in several bridges, heightening the visual cohesiveness of the Parkway. Among the elements which appear in more than one bridge are the state seal and its grape vines, concentric receding surfaces, and geometric forms. Many bridges include historical depictions of Connecticut's Native American inhabitants, early Puritan settlers, and even the design and construction of the Parkway itself. Abstract designs, such as stylized winged forms, reflect the Art Deco movement then at its peak, while other decorative treatments, such as a web full of spiders, are startlingly naturalistic.

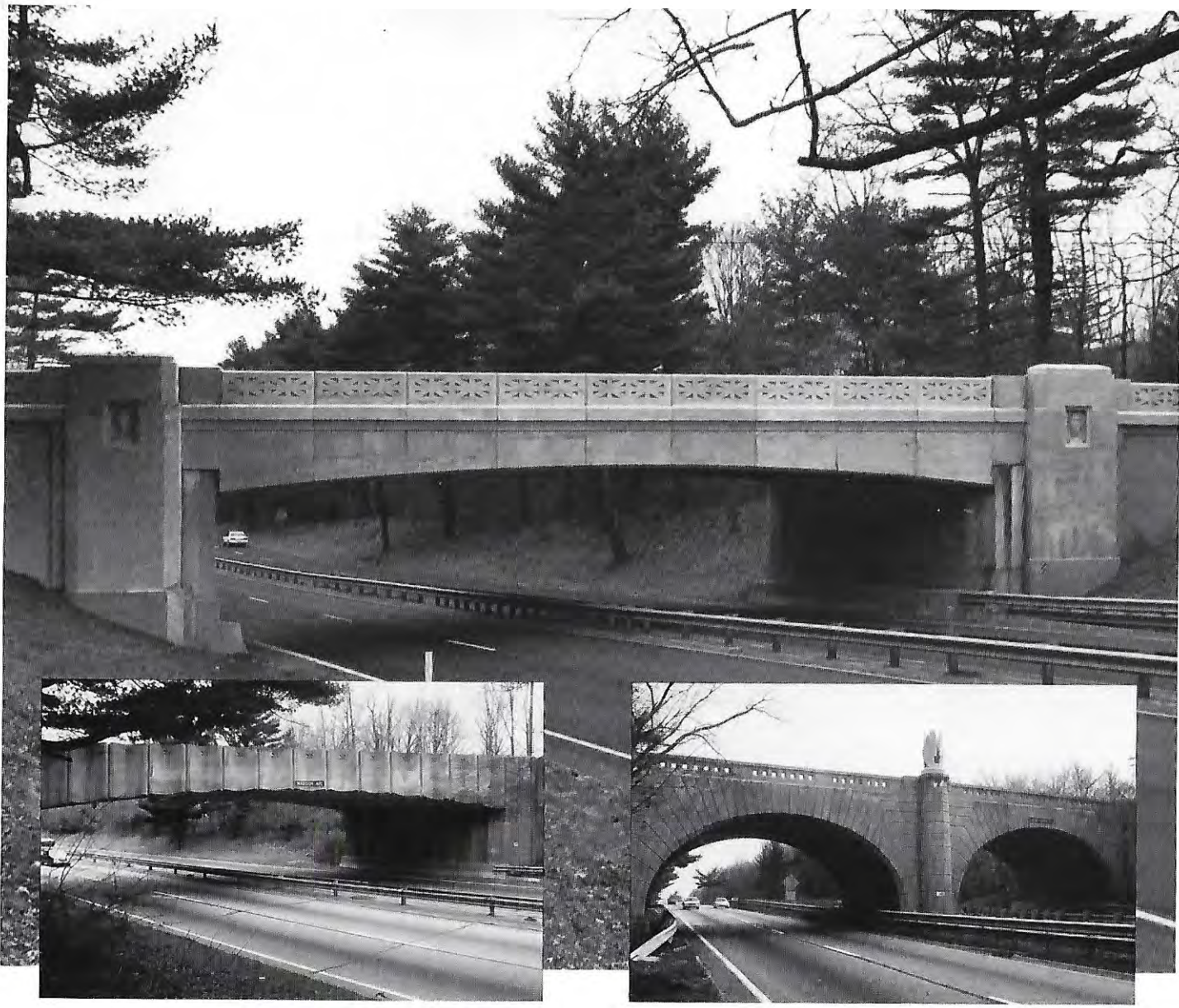
**T**echnologically, the bridges of the Merritt Parkway are mostly of rigid-frame reinforced-concrete construction. This technique, which makes the horizontal load-bearing members (usually shallow-arched beams) continuous with the vertical supports at the ends, had been used earlier in New York State parkways and also in a few Connecticut State Highway Department bridges of the 1920s. The rigid frame was particularly well-suited to a scenic highway like the Merritt; its arched form and relatively light appearance were compatible with the Parkway's aesthetic goals. The use of concrete also enhanced the decorative potential of the structures, since ornamental effects could be carried out relatively inexpensively with molds and the use of special aggregates to add color. The architectural embellishment of the Merritt's bridges added less than one percent to their cost.

Department engineer Leslie G. Sumner supervised the structural design of the bridges. Recognizing that the Merritt Parkway might not always

be devoted to medium-speed passenger vehicles (the Parkway was designed for 45 miles per hour), Sumner made the bridges strong enough to carry heavily loaded trucks. Sumner's foresight paid off almost immediately. During World War II, New England's truck traffic was diverted to the Merritt because of the blackout requirement along the shore line.

**A**fter the completion of the Parkway, work began on extensions to New Haven and Hartford, and the first bridges on what became the Wilbur Cross Parkway were heavily influenced by those of the Merritt. However, completion of the system was delayed until after World War II. By that time, the need for a wider, higher-speed road assumed greater importance than aesthetics, and landscaping and ornate bridges gave way to practicality.









## MOVABLE BRIDGES

**T**he communities along Connecticut's coast and navigable rivers have relied on movable bridges since Colonial times. Wherever highways and waterways intersected, some method of raising the bridge was needed to allow passage of tall-masted vessels. The first movable bridges were short wooden bascules, hinged at one end like medieval drawbridges and raised by a system of ropes and pulleys. Later, large timber-truss swing bridges came into use; these pivoted on a central pier, rather being raised.

Improvements in metal-truss technology allowed the construction of larger and stronger swing bridges. In addition to the trusses themselves, the many specialized components of swing bridges underwent constant development in the late 19th century. Motive power changed from hand-cranks to steam engines to electric drive, and iron-roller rim bearings gave way to phosphor-bronze center-bearing pivots.

By 1910, however, bascules had eclipsed swing

bridges for all but the longest spans. Bascules could more easily be built in congested settings, they provided a single wide channel rather than two narrower ones, and they could be opened part-way for smaller boats. Steel girders, carefully machined trunnions (the axles that bear the weight of the bascules as they open), concrete counterweights, and steam or electric-driven gearing replaced the timber bascule technology of an earlier era.

Throughout the 1890s and early 1900s, engineers patented many innovations in an attempt to lower the bascule's costs, provide greater reliability, and alleviate the stresses which constant operation placed on trunnions, drive mechanisms, and piers. Eventually, however, increasing motor-vehicle traffic made even brief delays for bridge openings unacceptable. In the late 1930s, the State Highway Department began replacing movable bridges with high-level crossings such as Middletown's Arrigoni Bridge.

## SAUGATUCK RIVER BRIDGE (Bridge No. 1349)

- ❑ Route 136 over Saugatuck River
- ❑ Westport
- ❑ Wrought-iron swing truss
- ❑ Length: 2 spans, 286' overall,  
142' swing span
- ❑ Built in 1884
- ❑ Union Bridge Company, fabricator



Connecticut's oldest surviving movable bridge consists of a hand-cranked swing span and a fixed approach span. Both are pin-connected Pratt through trusses. The swing span, actually two Pratt trusses joined by eyebars at the portal joints, revolves on large rollers that travel

along a circular track affixed to the pivot pier. To open the bridge, the operator uses a long T-handled socket wrench to turn a small pinion gear below the bridge deck. The pinion in turn meshes with a fixed ring gear, causing the bridge to rotate.

The bridge's fabricator, Union Bridge Company of Buffalo, N.Y., was a pioneer in the design and construction of movable bridges. The firm had built what they claimed in 1876 was the longest draw bridge ever built, 444', over the Mississippi River. One of the proprietors,

Charles H. Kellogg, was renowned for his patented method of die-forging eyebars. Under one name or another, the firm was in business from 1870 to 1900, when it was absorbed into the American Bridge Company.

Westport's swing bridge was listed on

the National Register of Historic Places in 1987. A rehabilitation project is currently underway.

Above right:  
ROLLERS SUPPORT THE BRIDGE AS  
IT REVOLVES ON THE PIVOT PIER.



## CONGRESS STREET BRIDGE (Bridge No. 4251)

- Congress Street over Pequonnock River ☐
- Bridgeport ☐
- Steel Scherzer rolling-lift bascule ☐
- Length: 5 spans, 425' overall, 86' double-leaf bascule ☐
- Built 1909-1911 ☐
- Raymond F. Stoddard, engineer ☐
- Fort Pitt Bridge Works, fabricator ☐

80

**B**ridgeport had more movable bridges than any other Connecticut city. In the early 20th century, it was the state's most heavily industrialized city, and waterways such as the Pequonnock River and Yellow Mill Channel provided transportation for coal and other vital

materials. The Congress Street bridge is the oldest of the city's four remaining historic movable bridges. It is an example of one of the most innovative designs, the patented Scherzer rolling lift. This type of bascule does not rotate on a pivot; instead, the lift span rolls back on a

huge curved track as it opens. The design, perfected in Chicago in the 1890s, gave greater clearance for the waterway as it rolled back and also did away with the high-stress pivots needed by other types of bascules. The disadvantage was that a substantial foundation had to be con-

structed to bear the weight of the bridge as it rolled back. With its concrete approach spans, tile-roofed operator's house, and original railing, the Congress Street Bridge is a relatively unaltered example of this important early 20th-century bridge type.

The bridge was built by a special city commission and cost nearly \$300,000. Since the bridge also carried streetcar traffic, the local trolley company contributed \$30,000.

## **EAST HADDAM BRIDGE (Bridge No. 1138)**

- ❑ Route 82 over Connecticut River
- ❑ East Haddam - Haddam
- ❑ Steel swing truss
- ❑ Length: 3 spans, 881' overall, 456' swing span
- ❑ Built in 1913
- ❑ Boller, Hodge & Baird, engineers
- ❑ American Bridge Company, fabricator



Spanning the Connecticut River near East Haddam's historic Goodspeed Opera House is a large pin-connected drawbridge designed by one of America's foremost bridge engineers. Alfred P. Boller (1840-1912) designed hundreds of large and complex bridges, including

several New York City drawbridges and the first railroad bridge across the Thames River at New London. He was also considered the nation's leading authority on deep bridge foundations, an important consideration in a bridge crossing the Connecticut River. The East

Haddam bridge incorporates numerous interesting technical features, including a center-bearing pivot and moving-wedge end lifts that support the ends of the bridge when closed. The large riveted Pennsylvania-truss fixed span, at 326', is itself one of the longest trusses in the

state. The piers and approach roadways were designed by supervising engineer Edward W. Bush, who had been engineer-in-charge on the Bulkeley Bridge project in Hartford.

The East Haddam Bridge was one of the first two bridges in Connecticut to be

paid for directly by the state; the other was the 1911 Connecticut Bridge at the river's mouth in Saybrook, replaced in 1948 by the Baldwin Bridge. At the time, the State Highway Department had no authority over bridges, so the legislature formed special commissions to build



these bridges. The East Haddam and Saybrook experience showed that such projects served a regional interest beyond the towns directly involved. The precedent set by these early state bridges led directly to legislation in 1915 that gave the State Highway Department responsi-

bility for all trunk-line bridges in Connecticut.

## WASHINGTON BRIDGE (Bridge No. 327)

- ☐ Route 1 over Housatonic River
- ☐ Milford - Stratford
- ☐ Steel trunnion-bearing bascule
- ☐ Length: 12 spans, 859' overall,  
151' double-leaf bascule
- ☐ Built in 1921
- ☐ Connecticut State Highway  
Department, engineers
- ☐ Bethlehem Steel Bridge, fabricator



When it was finished in 1921, Washington Bridge was the most expensive project ever undertaken by the Connecticut State Highway Department, costing \$1.5 million. It was one of a series of important structures planned in 1915 when the Department was given jurisdiction

over trunk-line bridges. However, rationing of steel during World War I delayed completion until 1921. The bridge's five 100' open-spandrel concrete arches testify to the high level of technical expertise achieved by the state bridge program within only a few years of

its inception. As the largest bridge on the state's most heavily traveled road, Washington Bridge was considered a showcase of the state engineers' talents.

The bascule consists of two leaves of arched deck girders that reflect the profile of the adjacent con-

crete spans. It was designed by noted consulting engineer J. A. L. Waddell and utilized an under-grade counterweight and drive arrangement patented by Thomas E. Brown of New York City. Brown's design is an example of the continued refinement of the bascule in the early

years of the 20th century.

Above left:  
**DRIVE GEARS.**



## MYSTIC RIVER BRIDGE (Bridge No. 362)

- Route 1 over Mystic River ☐
- Groton - Stonington ☐
- Steel balance-beam (Brown  
patent) bascule ☐
- Length: 4 spans, 223' overall, ☐
- 85' bascule span ☐
- Built in 1922 ☐
- Thomas E. Brown, engineer ☐
- American Bridge Company, ☐
- fabricator ☐

84

Few bridges are as much fun to watch in operation as the Route 1 bridge in Mystic, because unlike many bascules, its mechanical parts are all out in the open. Power to raise the bridge comes from electric motors, which drive large "bull wheels" connected with linkage arms to

the two plate girders which make up the lift span. Huge concrete weights at the ends of overhead rocking trusses counterbalance the bascule through another set of linkages.

This configuration was patented in 1918 by New York City consulting engineer

Thomas E. Brown. Besides being economical to build, the design had many advantages: accessibility of major parts for maintenance, automatic braking of the bridge at the top of its movement, latitude for imprecise motor control, and distribution of the bridge and counter-

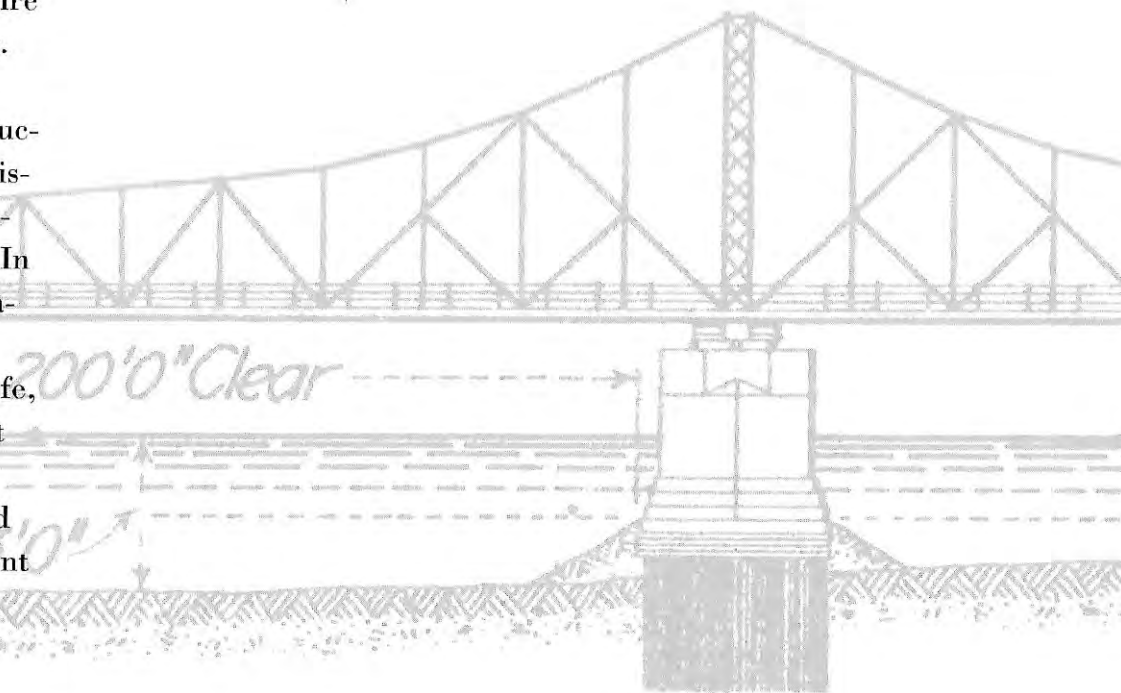
weight forces onto separate piers. It also suited its setting well, since the low level of the crossing relative to high tide would have made it difficult to put the mechanism and counterweight below the road. The project immediately won high praise for Brown's design, and Mystic River Bridge

was featured in several engineering journals and textbooks of the period.

Upgrading Route 1, the road along the shoreline, was a priority of the State Highway Department following World War I. This bridge was one of the last links in that effort.

## PRESERVATION CASE STUDIES

**P**reserving historic bridges for future generations will require imaginative planning. The following case studies present five successful examples of historic bridge preservation in Connecticut. In each case, transportation officials met the public's need for a safe, functional bridge. At the same time, they assured the continued survival of a significant heritage resource.





## CASE STUDY #1: WEST CORNWALL BRIDGE, CORNWALL-SHARON

**Bridge:** *Covered timber truss built in 1864 (p. 20)*

**Problem:** *Deteriorated trusses and floor, posted for four tons*

**Solution:** *Install steel deck as main structural system*

West Cornwall's covered bridge has a long history of problems. In 1939 the bridge was posted for a ten-ton limit after a state inspector observed, "Only the grace of God now prevents the structure from collapse." A few years later an oil truck (weighing twenty tons) plunged through the floor. Flood waters in 1955 nearly swept the bridge away. In 1961, a huge ice jam built up around the pier and abutments; only dynamiting the ice saved it from certain destruction.

A 1961 law required the State to maintain the covered bridge even if it was withdrawn from service, and local citizens opposed building a new high-level

bridge because of its impact on the village. Responding to their concerns, the State developed a solution that retained the old bridge.

The bridge was raised up about two feet, and a steel orthotropic deck was inserted to carry the traffic independently of the timber truss. The deck consists of two large side beams and a 3/8-inch thick top plate reinforced by 9-inch U-shaped ribs, all welded together. The new structure is barely

visible on the exterior, and a new wood-plank floor conceals it on the inside of the bridge. The timber truss was maintained intact, including the entire lower chord. The 1973 project won the Federal Highway Administration's outstanding historic preservation award.

The bridge remains one-lane wide, and vertical clearance is only eleven feet. However, an unrestricted crossing is just four miles to the south.





**Bridge:** *Cast-iron and wrought-iron 1871 through truss (p. 41)*

**Problem:** *Inadequate load-bearing capacity, deteriorated sidewalk*

**Solution:** *Install new I-beam bridge within historic structure*

**B**ecause it is adjacent to a railroad station, Riverside Avenue Bridge carries substantial traffic. Bypass of the historic structure with a separate, parallel bridge would have required taking property from the surrounding residential neighborhood and disrupting the existing street pattern.

The solution, designed by PRC Engineering of Stamford, Connecticut, was to build a new beam bridge entirely within the old truss. By constructing two intermediate piers between the tracks, the depth of the new structure was held to 24 inches. The truss's

## CASE STUDY #2: RIVERSIDE AVENUE BRIDGE, GREENWICH

floor beams (themselves a 1925 alteration) were partly cut away to create clearance for four I-beams, which carry a new concrete-slab deck. The truss's original lower joints were retained intact. The new bridge, which is structurally independent of the truss, provides a roadway width of 21 feet, with 14 feet of vertical clearance under the truss's portals.

Other aspects of the 1989 rehabilitation, which cost \$1.5 million, affected the appearance of the bridge but not its historic integrity. On the east side, a new free-standing sidewalk and stairway structure connects with the train platform below, and roadway barriers along the inside of the truss provide protection for the bridge's easily damaged cast-iron uprights.



## CASE STUDY #3: EAST HADDAM BRIDGE, EAST HADDAM-HADDAM



**Bridge:** *Steel swing bridge built in 1913 (p. 81)*

**Problem:** *Overstressed eyebars*

**Solution:** *Reinforce eyebars with new parallel members*

According to two engineering analyses, the eyebars that form most of the upper chord of this large steel swing bridge appeared to be overstressed. These critical components, which carry the whole weight of the structure when open, were difficult to inspect and impossible to test in place. Consequently, the bridge was posted for a fifteen-ton limit while State transportation engineers considered methods of strengthening the bridge.

The answer was to supplement each set of eyebars with a pair of parallel bars running between the original members. The new bars are connected to the existing joints with high-strength bolts and connection plates. No original

material was compromised by this solution. The new members are visually unobtrusive, and they are not likely to be mistaken for part of the original design.

Other components of the 1985 rehabilitation of the bridge were new steel-grate decks on both the fixed and movable spans, new guardrails, and

improvements to the operating machinery. The eyebar reinforcement accounted for approximately one-fourth of the project's \$1.5 million cost.





**Bridge:** *Wrought-iron pony truss built c. 1870 (p.40)*

**Problem:** *Inadequate load-bearing capacity*

**Solution:** *Relocate bridge to non-vehicular crossing*

This bridge formerly carried Mill Hill Road in Fairfield over Metro North's railroad tracks. In 1979, the State of Connecticut undertook the improvement of the crossing as part of a program to repair or replace structurally deficient town bridges that crossed rail lines. It was considered impractical to repair archaic trusses such as this one.

In order to expedite the bridge's replacement, the Town of Fairfield offered a relocation site about one and one half miles away. The bridge was moved intact as part of the construction contract for the new structure.

Since the bridge was primarily signif-

## CASE STUDY #4: PINE CREEK PARK BRIDGE, FAIRFIELD

cant for its intrinsic technology and had been moved once already, relocation in no way reduced its historical value. To the contrary, relocation made the bridge more accessible, and removal of the railroad's protective fencing allowed a better view of its details. The bridge is functional (it carries a nature trail across a flood channel of Pine Creek), and in the

years ahead, it will be a link between two parks still under development.

An unanticipated benefit of relocating the bridge is a better appreciation of its historical significance. Further research has shown the bridge to be about twenty years older, and much rarer as a type, than was thought at the time.





## CASE STUDY #5: PEQUABUCK BRIDGE, FARMINGTON

**Bridge:** *Stone arch built in 1833 (p. 25)*

**Problem:** *Cracked masonry and damaged road surface*

**Solution:** *Build new bridge and redirect river channel to the west*

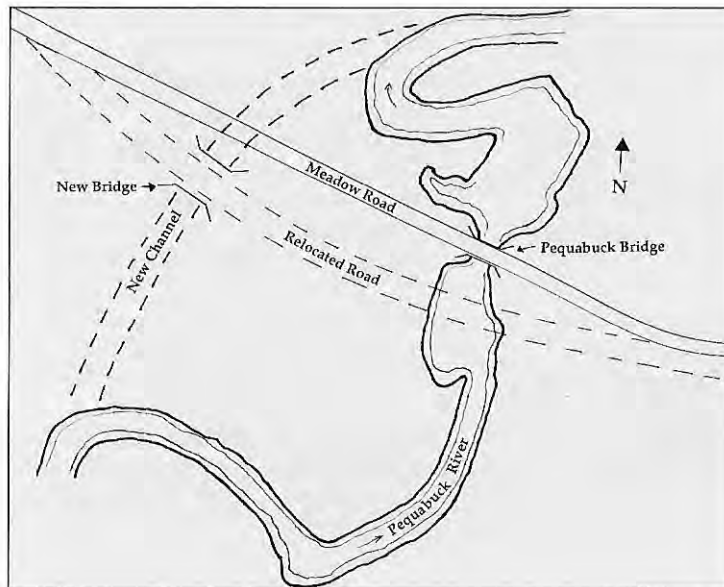
Although normally a small, quiet stream, the Pequabuck River is subject to severe flooding, which damaged the masonry of this bridge over its 150 years of service. When closed in 1982, the bridge had a longitudinal crack along the full length of the arch and several gaping holes in the roadway, one of which went entirely through to the underside.

At the time, traffic demands on Meadow Road were increasing, and there was interest in widening the road. Other citizens voiced concern that a wider road would alter the character of the area. When the bridge was

closed, local police, emergency and school officials urged that the road be returned to service as soon as possible.

From a preservation point of view, the town's solution was a model bypass. The new bridge is located well away from the historic structure, leaving its setting intact. Although the

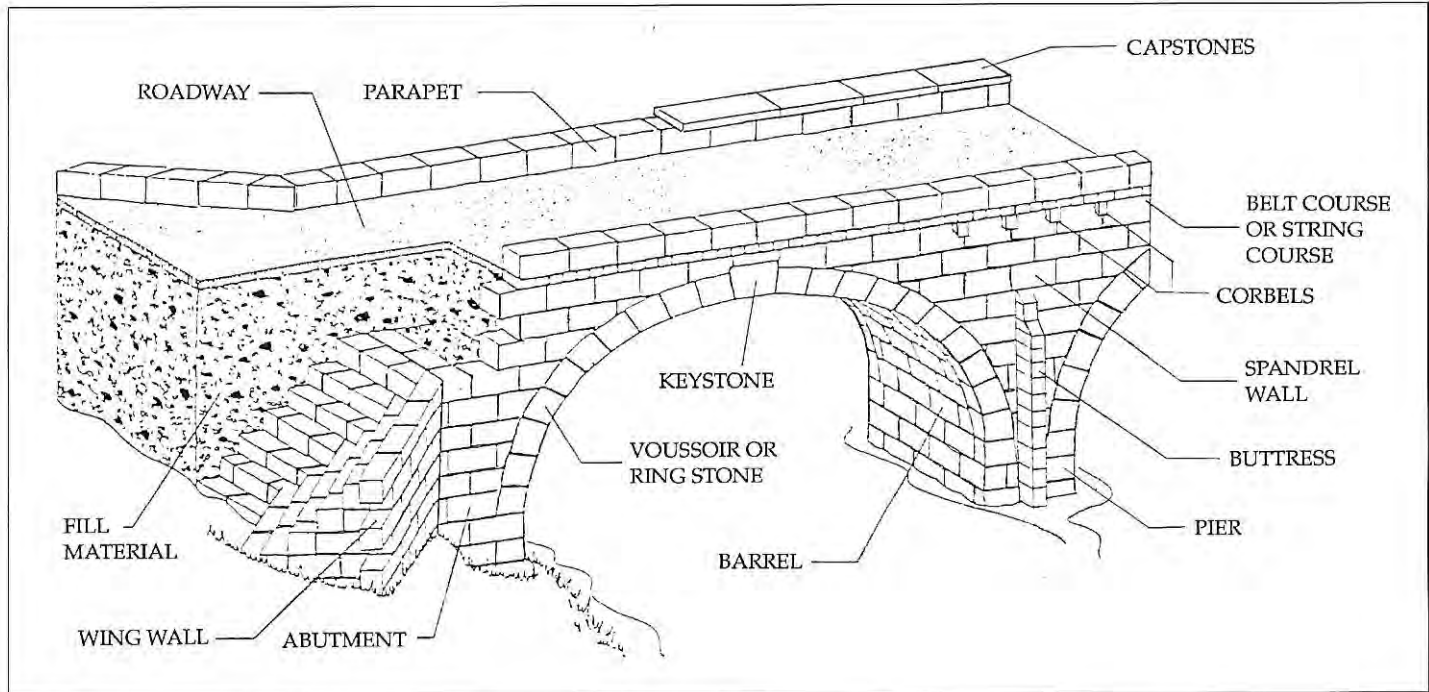
Pequabuck River was redirected into another channel, the old river course was not completely filled in, and sometimes there is water under the bridge. Most importantly, the old bridge was not simply left to decay; it carries the sidewalk and bicycle path for the new road.



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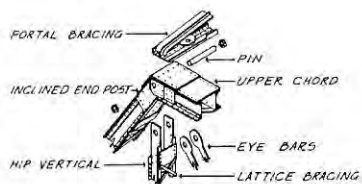
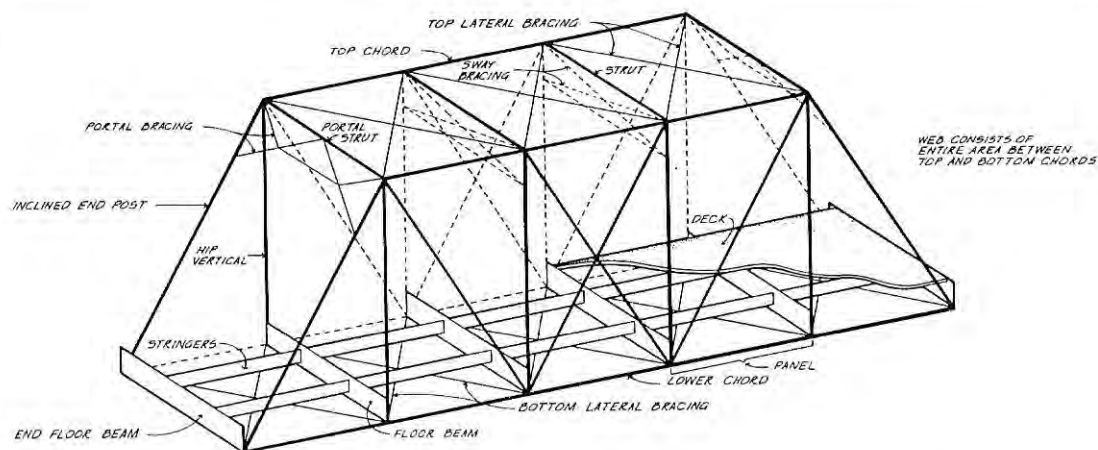
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## MASONRY ARCH TERMS

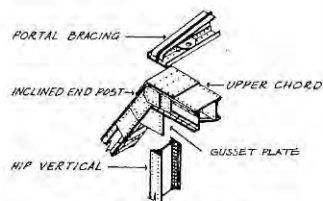


Adapted from *Historic Highway Bridges in Pennsylvania: Preservation Guide*. Used with permission.

# COMPONENTS OF A TRUSS BRIDGE



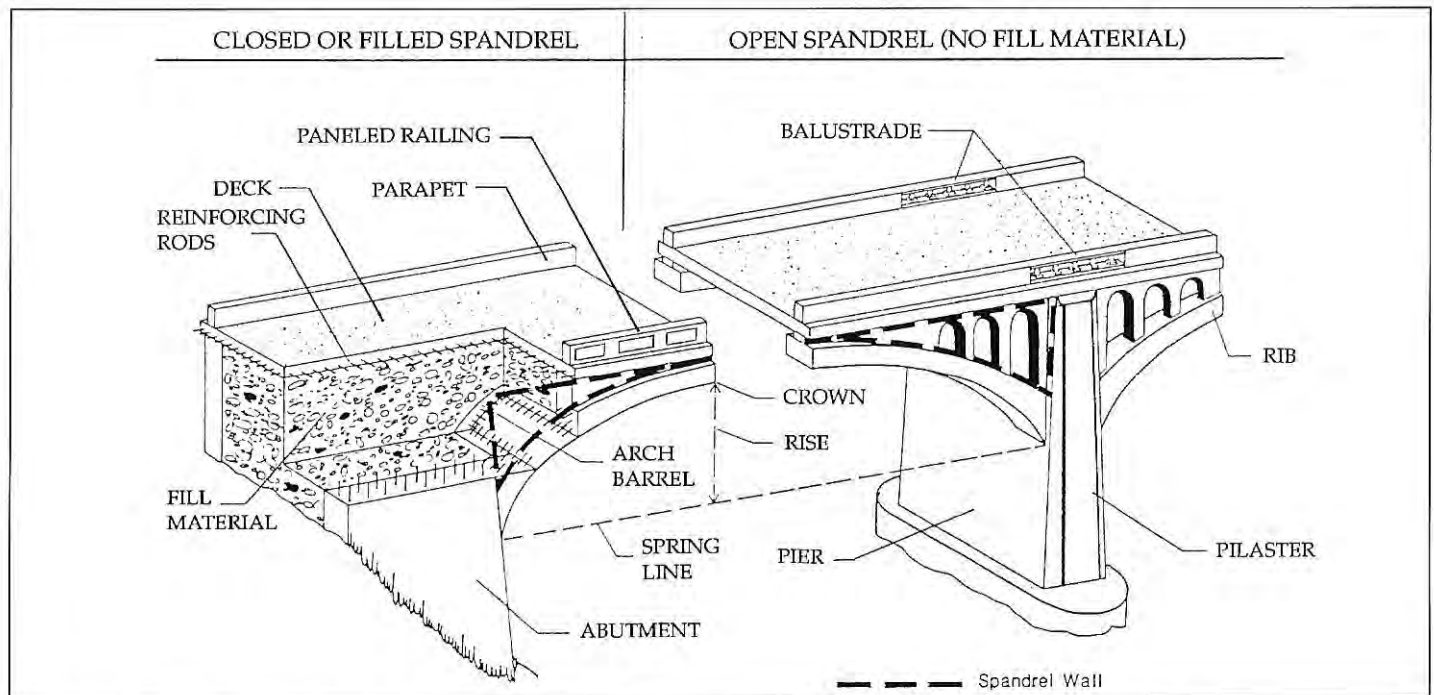
PINNED CONNECTION



RIVETED CONNECTION

Source:  
*Historic  
 American  
 Engineering  
 Record*

## CONCRETE ARCH TERMS



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## NATIONAL REGISTER LISTINGS AND RECOMMENDATIONS

### Connecticut Highway Bridges Individually Listed on the National Register of Historic Places

Comstock Bridge, Bridge Street (closed) over Salmon River, Colchester-East Hampton, 1873 covered wooden truss

River Road Bridge, abandoned railroad over River Road, Colchester, 1887 stone arch

West Cornwall Bridge (Bridge No. 1338), Route 128 over Housatonic River, Cornwall-Sharon, 1864 covered wooden truss

Pequabuck Bridge, Meadow Road (bypassed) over Pequabuck River, Farmington, 1833 stone arch

Riverside Avenue Bridge, Riverside Avenue over Metro North, Greenwich, 1871 iron truss

Main Street Bridge (Bridge No. 1626), Main Street over Whitehead Highway, Hartford, 1833 stone arch

Bull's Bridge (Bridge No. 4453), Bull's Bridge Road over Housatonic River, Kent, 1842 covered wooden truss

Lovers Leap Bridge, Pumpkin Hill Road (bypassed) over Housatonic River, New Milford, 1895 iron truss

Boardman's Bridge, Boardman Road (bypassed) over Housatonic River, New Milford, 1888 iron truss

Main Street Bridge (Bridge No. 2212), Main Street over Rippowam River, Stamford, 1888 iron truss

Saugatuck River Bridge (Bridge No. 1349), Route 136 over Saugatuck River, Westport, 1884 iron-truss swing bridge

### Connecticut Highway Bridges Judged Individually Eligible for the National Register of Historic Places

Bridge No. 1496, Route 181 over Farmington River, Barkhamsted, 1939 steel truss

Bridge No. 3788, Depot Street over Naugatuck River, Beacon Falls, 1935 steel truss

Bridge No. 2656, Route 132 over East Spring Brook, Bethlehem, c.1897 stone arch

Bridge No. 1508, Route 189 over Washington Brook, Bloomfield, 1913 concrete arch

Bridge No. 325, Route 1 over Stillman Pond, Bridgeport, 1910 concrete arch

Bridge No. 3637, Stratford Avenue over Yellow Mill Pond, Bridgeport, 1929 bascule

Bridge No. 4250, Grand Street over Pequonnock River, Bridgeport, 1916 steel bascule

Bridge No. 4251, Congress Street over Pequonnock River, Bridgeport, 1911 steel bascule

Bridge No. 4252, East Washington Avenue over Pequonnock River, Bridgeport, 1925 steel bascule

Bridge No. 4455, Central Avenue over Lewis Gut, Bridgeport, 1924 steel swing bridge

Bridge No. 900, Route 25 over Still River, Brookfield, 1920 stone arch

Bridge No. 5091, Aldrich Road over Still River, Brookfield, 1895 steel truss

Bridge No. 562, Route 7 over Housatonic River, Canaan, 1931 steel truss

Bridge No. 1649, Route 668 over Quinebaug River, Canterbury, 1937 steel truss

Bridge No. 5222, Town Bridge Road over Farmington River, Canton, 1895 iron truss

Bridge No. 1537, Route 198 over Natchaug River, Chaplin, 1926 concrete arch

Bridge No. 5144, Wolford Hill Road over Sandy Brook, Colebrook, 1915 steel truss

Bridge No. 4619, Village Hill Road over Ten Mile River, Columbia-Lebanon, c.1870 stone arch

Bridge No. 560, Route 7 over Housatonic River, Cornwall, 1930 concrete arch

Bridge No. 4622, Flanders Road over Willimantic River, Coventry-Mansfield, 1914 steel truss

Bridge No. 4125, Crosby Street over Padanaram Brook, Danbury, 1899 stone arch

Bridge No. 4992, Rings End Road over Gorham Pond, Darien, 1930 concrete arch

Bridge No. 1138, Route 82 over Connecticut River, East Haddam-Haddam, 1913 steel swing bridge

Bridge No. 4496, Forbes Street over Hockanum River, East Hartford, 1903 concrete arch

Bridge No. 1397, Route 156 over Niantic River, East Lyme-Waterford, 1921 steel swing bridge

Bridge No. 1524, Route 191 over Scantic River, East Windsor, 1925 steel truss

Bridge No. 4500, Melrose Road over Scantic River, East Windsor, 1888 iron truss

Bridge No. 1487, Route 177 over Farmington River, Farmington, 1939 steel truss

Bridge No. 1401, Route 160 over Roaring Brook, Glastonbury, c.1870 brick arch

Bridge No. 3671, Naubuc Avenue over Brewer Brook, Glastonbury, 1871 stone arch

Bridge No. 3674, Byram Road over Metro North, Greenwich, 1893 steel truss

Bridge No. 3846, Drinkwater Place over Metro North, Greenwich, 1895 steel truss

Bridge No. 5011, Shore Road #1 over Horseneck Brook, Greenwich, 1905 stone arch

Stone arch, Field Point Road over Metro North, Greenwich, 1894

Stone arch, Arch Street over Metro North, Greenwich, c.1870

Bridge No. 362, Route 1 over Mystic River, Groton-Stonington, 1922 steel bascule

Bridge No. 977, Route 44 over North Branch Park River, Hartford, 1906 concrete arch

Bridge No. 979, Route 44 over Conrail, Hartford, 1871 brick arch

Bridge No. 980A, Route 84 over Connecticut River, Hartford-East Hartford, 1908 stone arch

Bridge No. 3781, Walnut Street over Conrail, Hartford, 1907 steel truss

Bridge No. 1594, Route 341 over Housatonic River, Kent, 1923 steel truss

Bridge No. 4700, Peep Toad Road over Peep Toad Brook, Killingly, c.1850 stone arch

Bridge No. 4704, Attawaugan Road over Five Mile River, Killingly, c.1860 stone arch

Bridge No. 1132, Route 80 over Hammonasset River, Killingworth-Madison, 1934 concrete arch

Stone arch, Kinsman Road Extension under Providence & Worcester Railroad, Lisbon, c.1850

Bridge No. 3793, North Main Street over Hockanum River, Manchester, c.1869 stone arch

Stone arch, Hartford Road over dry ditch, Manchester, c.1900

Bridge No. 4727, Mount Hope Road over Mount Hope River, Mansfield, 1901 steel truss

Bridge No. 4839, Cooper Street over Harbor Brook, Meriden, 1892 stone arch

Iron truss, bypassed near Oregon Road over Quinnipiac River, Meriden, 1891

Bridge No. 639, Conrail over Route 9, Middletown, 1910 steel truss

Bridge No. 4536, Berlin Street over Coginchaug River, Middletown, 1918 concrete arch

Concrete arch, Wadsworth State Park Path over Laurel Brook, Middletown, 1908

Bridge No. 524, Route 66 over Connecticut River, Middletown-Portland, 1938 steel arch

Bridge No. 327, Route 1 over Housatonic River, Milford-Stratford, 1921 steel bascule

Bridge No. 1328, Route 162 over Wepawaug River, Milford, 1889 stone arch

Bridge No. 3645, River Street over Wepawaug River, Milford, 1934 concrete arch

Bridge No. 4214, Maple Avenue over Naugatuck River, Naugatuck, 1912 concrete arch

Bridge No. 5217, Stanley Quarter Park Road over brook, New Britain, 1925 concrete arch

Bridge No. 5218, Stanley Park Road over spillway, New Britain, 1936 concrete arch

Bridge No. 1561, Route 219 over Farmington River, New Hartford, 1930 steel truss

Bridge No. 4434, Black Ridge Road over Farmington River, New Hartford, 1936 steel truss

Bridge No. 3806, Chapel Street over West River, New Haven, 1882 iron truss

Bridge No. 337, Route 1 over Quinnipiac River, New Haven, 1924 steel bascule

Bridge No. 3752, Olive Street over Conrail, New Haven, 1907 steel truss

Bridge No. 3808, Edgewood Avenue over West River, New Haven, 1910 concrete arch

Bridge No. 3870, Fair Street over Metro North, New Haven, 1907 concrete arch

Bridge No. 3871, Crown Street over Conrail, New Haven, 1907 concrete arch

Bridge No. 3872, Chapel Street over Conrail, New Haven, 1907 concrete arch

Bridge No. 3873, Court Street over Conrail, New Haven, 1907 concrete arch

Bridge No. 3874, Grand Avenue over Conrail, New Haven, 1907 concrete arch

Bridge No. 3879, Clifton Street over Conrail, New Haven, c.1885 stone arch

Bridge No. 4138, Wintergreen Avenue over Town Farm Brook, New Haven, 1890 stone arch

Bridge No. 3998, Ferry Street over Metro North, New Haven, 1912 steel truss

Bridge No. 1607, State Route 437 over railroad, New London, 1889 steel truss

Iron truss, abandoned road over Pootatuck River, Newtown, 1890

Bridge No. 507, Route 816 over Housatonic River, Newtown-Southbury, 1934 steel truss

Bridge No. 3850, Bridge Street over railroad, Norwalk, 1891 steel truss

Bridge No. 4130, Perry Avenue over Silvermine River, Norwalk, 1899 stone arch

Bridge No. 4155, Clover Avenue over Norwalk River, Norwalk, 1912 stone arch

Railroad bridge over South Main Street, Norwalk, 1896 steel truss

Bridge No. 4746, Sunnyside Street over Yantic River, Norwich, 1908 stone arch

Bridge No. 1415, Route 169 over Shetucket River, Norwich-Lisbon, 1938 steel truss

Bridge No. 948, Route 34 over Wepawaug River, Orange, 1942 concrete arch

Bridge No. 4402, Brunswick Avenue over Moosup River, Plainfield, 1886 iron truss

Bridge No. 4403, River Street #1 over Moosup River, Plainfield, 1886 iron truss

Bridge No. 4754, Packerville Road over Mill Brook, Plainfield, c.1850 stone arch

Bridge No. 4139, Tunnel Road and South Main Street over railroad tunnel, Plymouth, 1910 concrete arch

Stone arch, Middle Haddam Road under Air Line Railroad (abandoned), Portland, c.1890

Bridge No. 992, Route 44 over Quinebaug River, Putnam, 1925 concrete arch

Stone arch, Bates Avenue over Little Dam Tavern Brook, Putnam, c.1840

Stone arch, Arch Street over Providence and Worcester Railroad, Putnam, 1901

Bridge No. 963, Route 41 over Sage Ravine Brook, Salisbury, 1929 concrete arch

Bridge No. 966, Route 44 over Housatonic River, Salisbury, 1918 concrete arch

Bridge No. 2305, Route 44 over Burton Brook, Salisbury, 1873 stone arch

Bridge No. 5191, Sharon Station Road over Webatuck River, Sharon, 1885 iron truss

Bridge No. 1659, Route 712 over Housatonic River, Shelton-Derby, 1918 concrete arch

Bridge No. 1857, Route 315 over Farmington River, Simsbury, 1894 iron truss

Bridge No. 4779, Spring Street over Middle River, Stafford, 1912 stone arch

Bridge No. 3682, South State Street over Rippowam River, Stamford, 1847 stone arch

Bridge No. 4182, White Rock Road over Pawcatuck River, Stonington-Westerly (RI), 1906 steel truss

Bridge No. 455, Route 159 over Stoney Brook, Suffield, 1929 concrete arch

Bridge No. 603, Waterbury Road (Route 848) over Naugatuck River, Thomaston, 1930 concrete arch

Bridge No. 1617, Tunnel Road under abandoned railroad, Vernon, 1849 stone arch

Bridge No. 4575, Main Street over Tankerhoosen River, Vernon, 1891 iron truss

Bridge No. 1079, Routes 150 and 71  
(Main Street) under Amtrak, Walling-  
ford, c.1870 stone arch

Bridge No. 5159, Romford Road over  
Bantam River, Washington, 1888 iron  
truss

Bridge No. 4534, Washington Avenue  
over Mad River, Waterbury, 1878 iron  
truss

Bridge No. 5038, Sheffield Street over  
Hancock Brook, Waterbury, 1890 iron  
truss

Bridge No. 1117, West Main Street  
over Naugatuck River, Waterbury,  
1922 concrete arch

Bridge No. 4166, Freight Street over  
Naugatuck River, Waterbury, 1925  
concrete arch

Bridge No. 5041, Huntingdon Avenue  
over Steele Brook, Waterbury, 1935  
concrete arch

Bridge No. 4408, Skilton Road over  
Nonewaug River, Watertown, 1865  
stone arch

Bridge No. 3651, North Main Street  
over Trout Brook, West Hartford,  
1901 concrete arch

Bridge No. 349, Route 1 over  
Patchaug River, Westbrook, 1925 steel  
truss

Bridge No. 3852, Hales Road over rail-  
road, Westport, 1891 steel truss

Bridge No. 3854, Sasco Creek Road  
over railroad, Westport, c.1891  
steel truss

Bridge No. 319, Route 1 over  
Saugatuck River, Westport, 1917 con-  
crete girder

Bridge No. 1850, Route 601 over  
Willimantic River, Windham, 1869  
stone arch

Bridge No. 1852, Route 32 over  
Willimantic River, Windham, 1868  
stone arch

Bridge No. 1360, Route 140 over Con-  
necticut River, East Windsor-Windsor  
Locks, 1921 steel truss

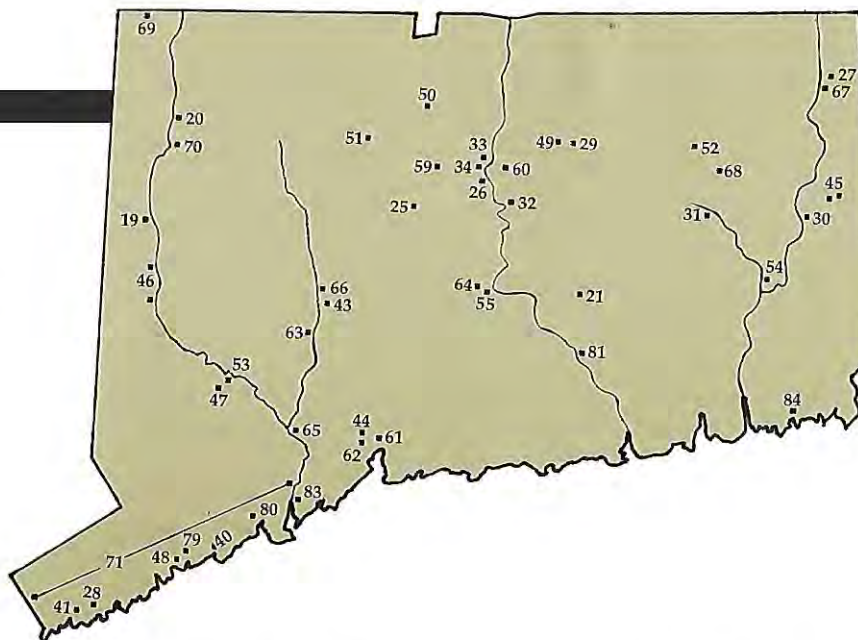
Bridge No. 4422, Papermill Road over  
Weekepeemee River, Woodbury,  
1893 steel girder

Bridge No. 5065, Minor Town Road  
over Nonewaug River, Woodbury,  
1890 iron truss

## INDEX MAP

*Bridges included in this book,  
listed below in order by town.*

*Numbers refer to page numbers  
in this book.*



|                         |                              |    |                     |                                 |    |
|-------------------------|------------------------------|----|---------------------|---------------------------------|----|
| Bridgeport              | Congress Street Bridge       | 30 | New Haven           | Edgewood Avenue Bridge          | 62 |
| Chaplin                 | Diana's Pool Bridge          | 68 | New Milford         | Boardman's Bridge               | 46 |
| Canton                  | Town Bridge Road Bridge      | 51 | New Milford         | Lovers Leap Bridge              | 46 |
| Colchester-East Hampton | Comstock Bridge              | 21 | Newtown-Southbury   | Bridge No. 507                  | 53 |
| Cornwall                | Bridge No. 560               | 70 | Newtown             | Sandy Hook Iron Bridge          | 47 |
| Cornwall-Sharon         | West Cornwall Bridge         | 20 | Norwich-Lisbon      | Bridge No. 1415                 | 54 |
| Derby-Shelton           | Derby-Shelton Bridge         | 65 | Plainfield          | Glen Falls Bridge               | 45 |
| East Haddam-Haddam      | East Haddam Bridge           | 81 | Plainfield          | Packerville Bridge              | 30 |
| East Hartford           | Burnside Bridge              | 60 | Plainfield          | River Street Bridge             | 45 |
| Fairfield               | Pine Creek Park Bridge       | 40 | Putnam              | Bates Avenue Bridge             | 27 |
| Farmington              | Pequabuck Bridge             | 25 | Putnam              | Putnam Memorial Bridge          | 67 |
| Glastonbury             | Naubuc Avenue Bridge         | 32 | Salisbury           | Bridge No. 963                  | 69 |
| Greenwich               | Riverside Avenue Bridge      | 41 | Simsbury            | Drake Hill Road Bridge          | 50 |
| Groton-Stonington       | Mystic River Bridge          | 84 | Stamford            | South State Street Bridge       | 28 |
| Hartford                | Hartford Railroad Tunnel     | 33 | Vernon              | Talcottville Main Street Bridge | 49 |
| Hartford                | Main Street Bridge           | 26 | Vernon              | Vernon Tunnel                   | 29 |
| Hartford-East Hartford  | Bulkeley Bridge              | 34 | Waterbury           | Washington Avenue Bridge        | 43 |
| Kent                    | Bull's Bridge                | 19 | Waterbury           | West Main Street Bridge         | 66 |
| Mansfield               | Mt. Hope Bridge              | 52 | Westport            | Hales Road Bridge               | 48 |
| Middletown              | Berlin Street Bridge         | 64 | Westport            | Saugatuck River Bridge          | 79 |
| Middletown-Portland     | Arrigoni Bridge              | 55 | West Hartford       | North Main Street Bridge        | 59 |
| Milford-Stratford       | Washington Bridge            | 83 | Windham             | Bridge Street Bridge            | 31 |
| Naugatuck               | Whittemore Memorial Bridge   | 63 |                     |                                 |    |
| New Haven               | Chapel St. West River Bridge | 44 |                     |                                 |    |
| New Haven               | Court Street Railroad Bridge | 61 | Greenwich-Stratford | Merritt Parkway Bridges         | 71 |



